march 1953

American Foundryman

THE FOUNDRYMEN'S OWN MAGAZINE

35 The dollar has two sides

36 Getting the most out of naturally bonded sands

40 The foundry quizmaster

44 Multiple molding in a malleable shop

54 Practical foundry applications of ratio gating

"Top charging on our two electric furnaces is like adding a third furnace!"

reports Newport Steel Corp., Newport, Ky.

Lectromelt* fast-opening furnace top in its charging position.

Two of Newport Steel's 80-ton electric furnaces are equipped with the Lectromelt lift-and-swing top-charge feature; their third is door-charged. You have a comparison based on facts, therefore, in these production figures.

Top charged furnaces have reached 4% more tonnage per heat, 30% more heats per month, and 36% more average monthly output than that of door charged furnaces.

"You can't melt scrap in the stockyard", says the Superintendent of Steel Production. "Top charging lets you get scrap into the furnaces fast." Records show that Lectromelt top charging is accomplished here in half the time required for door charging, thereby helping to maintain high efficiencies and lower costs.

For Catalog No. 8 giving you more details on Lectromelt Furnaces, write Pittsburgh Lectromelt Furnace Corporation, 316 32nd Street, Pittsburgh 30, Pennsylvania.

Manufactured in . . . CANADA: Lectromelt Furnaces of Canada, Ltd., Toronto 2 . . . ENGLAND: Birlec, Ltd., Birmingham . . . FRANCE: Stein et Roubaix, Paris . . . BELGIUM: S. A. Belge Stein et Roubaix, Bressoux-Liege . . . SPAIN: General Electrica Espanola, Bilbao . . . ITALY: Forni Stein, Genoa. JAPAN: Daido Steel Co. Ltd., Nagoya

*REG. T. M. U. S. PAT. OFF.

WHEN YOU MELT...

MOORE RAPID

Lectromelt

if yours is an iron foundry...

and your sand additives cost you more than

$1.00 per ton of castings produced

you're wasting money!

The above is quite a serious claim, but we can prove it! First, by establishing the fact that the sand required to produce a ton of castings can be properly prepared with a dollar's worth of CROWN HILL SEACOAL, FEDERAL GREEN BOND BENTONITE and FEDERAL SAND STABILIZER and, secondly, that the use of these three additives produces thoroughly satisfactory results.

The first part can be proved by explaining that at a prominent automotive production foundry, a thorough study of sand preparation costs has been made, using the above three additives. This study proves that the additives for this method of sand preparation cost *less than one dollar per ton of castings produced!*

Proof of the second statement lies in the fact that an overwhelming majority of iron foundries use this method of sand preparation, and do so because it is an easy and economical way to prepare sand and because excellent castings can be produced in sand thus prepared.

So, if you're using *any other method* of sand preparation—using other materials that cost more and require exacting sand control, why not check into this tried and true method—this economical method of preparing sand. We have a new bulletin that tells all about it—and will be glad to forward a copy. Send for it TODAY!

CROWN HILL SEACOAL

Produced by FEDERAL at Crown Hill, West Virginia. *High* in volatile combustible material, *low* in sulphur and ash content—basic requirements for a top quality seacoal. Ground or granulated to properly match the sand used.

FEDERAL GREEN BOND

Mined, processed and guaranteed by FEDERAL and unexcelled in uniformity and ability to develop green and dry strength. Truly the best of the bentonites!

FEDERAL SAND STABILIZER

A processed cellulose sand additive. Its high combustibility allows sand to expand evenly to eliminate casting defects. It increases sand flowability to provide better ramming conditions. And it attracts moisture to broaden the safe moisture range.

FEDERAL

The **FEDERAL FOUNDRY SUPPLY** *Company*

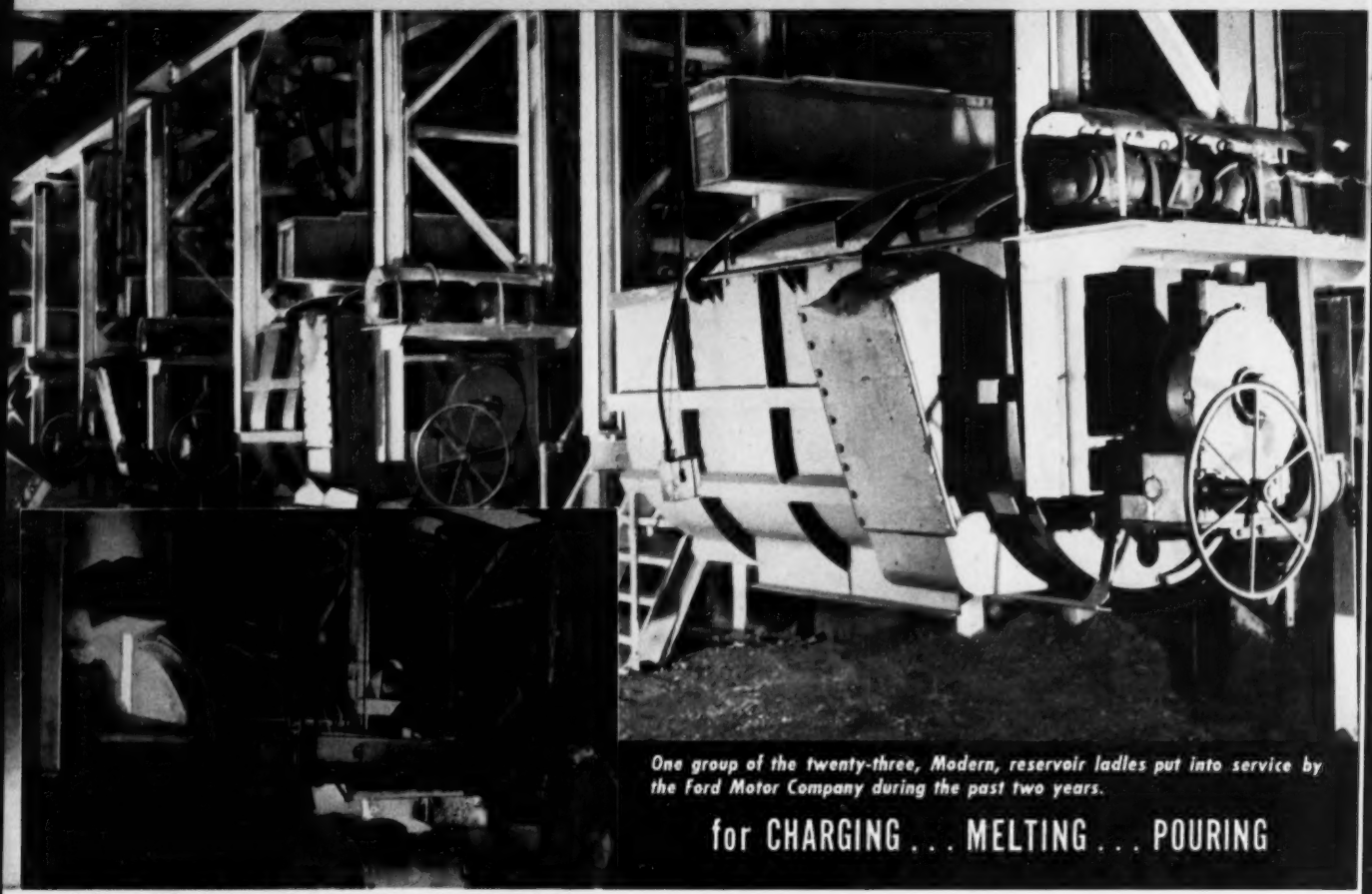
4600 EAST 71st STREET, CLEVELAND 5, OHIO

CROWN HILL, W. VA. • CHICAGO • DETROIT • MILWAUKEE • RICHMOND, VA. • ST. LOUIS • CHATTANOOGA • NEW YORK • UPTON, WYO.

IN TWIN CITIES: Charles D. Gallaher, 1050 S. Old Shakopee Rd., Minneapolis 20, Minn.

*1,200,000 Square Feet *IS* a Large Foundry

BUT, large or small here's a TIME TESTED service for you...



One group of the twenty-three, Modern, reservoir ladles put into service by the Ford Motor Company during the past two years.

for CHARGING . . . MELTING . . . POURING

*Ladles at *Cleveland are—16,000 pounds capacity, electric driven and all welded construction. Overhead mounting of these ladles permits maximum accessibility for the metal carriers and ready clean-up around the cupolas. Gas fired pre-heaters are used.*

Whether or not your problem is comparable to Ford's production of 1,400 tons daily, or shaking-out only 100 tons a month in your own foundry, MODERN equipment, counsel and experience are as close to you as your 'phone.

Ladles shown in service here at the new Ford foundry in Cleveland receive all the metal from the cupolas for transfer over hot metal carriers. Each ladle is electrically driven and engineered to operate at 16,000 pounds capacity. Double end-wall construction adds rigidity for trunnions and helps to lengthen bearing life.

In these and other ways in foundries large and small MODERN foundry equipment has been serving well for more than thirty-five years. Whether your problem involves CHARGING . . . MELTING . . . POURING—or the coordination of every movement from scrap yard to shake-out—you will build around TIME TESTED methods when you put all your problems to MODERN engineers . . .

*FORD MOTOR COMPANY
CLEVELAND, OHIO

FEMA

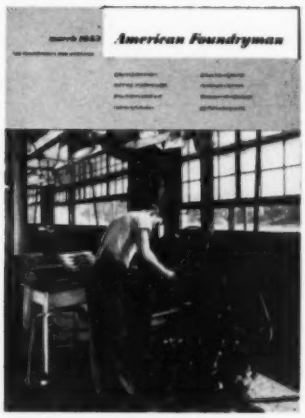
MODERN EQUIPMENT COMPANY
Port Washington, Wisconsin

MODERN REPRESENTATIVES IN ALL PARTS OF THE WORLD

American Foundryman

March 1953 / *Volume 23 • Number 3*

Official Publication of American Foundrymen's Society



Setting cores in a section of a stack mold in the malleable shop of Chain Belt Co., Milwaukee. How to make mold sections which combine cope and drag impressions on opposite faces of the section is described in Joseph G. Kropka's 1953 Convention paper starting on page 44. His story covers standardization of equipment, sand handling, molding, pouring, and shakeout.

Trends

35 The dollar has two sides

Operations and methods

36 How to get the most out of naturally bonded sands
Clyde A. Sanders

40 The foundry quizmaster

44 Multiple molding in a malleable shop
Joseph G. Kropka

54 Practical foundry applications of ratio gating
L. L. Lucas

73 Shop talk—practical questions and answers

Technology

50 Dephosphorization of iron in the basic cupola
Jack E. Bolt

59 About practical heat transfer (contd.)
Wm. S. Pellini

77 Residual stresses in cast iron
L. A. Aldinger

In the news

41 Progress report on 1953 A.F.S. convention

58 Tentative program—1953 International Congress in Paris

80 Wisconsin regional foundry conference

83 California regional foundry conference

97 News of A.F.S. chapters

Departments

11 *Letters to the editor*

15 *Products and processes*

18 *Free foundry information*

23 *Talk of the industry*

29 *Foundrymen in the news*

69 *Future meetings and exhibits*

73 *"Now there's an idea"*

90 *Foundry trade news*

93 *Abstracts*

114 *Advertiser's index*

115 *Classified advertising*

Publications Committee

H. J. Rowe, *Chairman*
Aluminum Co. of America, Pittsburgh
Harry W. Dietert
Harry W. Dietert Co., Detroit
C. H. Lorig
Battelle Memorial Institute
W. D. McMillan
International Harvester Co., Chicago
H. M. St. John
Crane Co., Chicago
F. J. Walls
International Nickel Co., Detroit

A.F.S. Headquarters

616 S. Michigan, Chicago 5
Wm. W. Maloney
Secretary-Treasurer
S. C. Massari, *Technical Director*

American Foundryman

H. F. Scobie, *Editor*
Terry Koeller, *Advertising Manager*
Helen Dudek, *Advertising Production*
LaVerne Lahn, *Circulation*

Advertising representatives

Midwestern
Dwight Early & Sons,
100 N. LaSalle St., Chicago
Central 6-2184

Central
R. E. Cleary, *Commercial & Savings Bank Bldg., Berea, Ohio*
Berea 4-7719

Eastern
Robert B. Weston,
6 E. 39th St., New York
Murray Hill 5-9450

Published monthly by the American Foundrymen's Society, Inc., 616 S. Michigan Ave., Chicago 5. Subscription price in the U.S., Canada, and Mexico $3.00 per year; elsewhere, $6.00. Single copies 50c. Entered as Second Class Matter, July 22, 1938, under Act of March 3, 1879, at the Post Office, Chicago.

Get the right body in your foundry facings with

NATIONAL BENTONITE

Good foundrymen everywhere know that better bonding in their foundry facings means finer-finish castings, with fewer rejects. They know, too, that the right consistency of National Bentonite with their molding sand means good green strength and high hot strength for their molds.

That's why so many good foundrymen for years have been bonding with consistently high quality National Bentonite . . . for greater casting output with more accurate, manageable molds, with reduced hazards of blows and gas holes.

Write, phone or wire today and let us help you with your bonding problems.

FIRST CHOICE WITH MANY GOOD FOUNDRYMEN FOR YEARS

Quick Service From Better Foundry Suppliers Everywhere

Baroid

Baroid Sales Division ☆ National Lead Company

Bentonite Sales Office: Railway Exchange Building, Chicago 4, Illinois

KEEP YOUR BONDING AGENT RIGHT AND YOUR MOISTURE TO A MINIMUM

Bonding agents are frequently blamed for many common casting problems . . . blows, scabs, porosity, rough finish, burn-ins, pin holes . . . when the fault generally belongs to an improper water balance in the molding sand, improper proportions in the formula, or improper moisture distribution in the mix.

A high moisture content in the mold mix, without the proper colloidal substance added for hot strength, will give a false plasticity to the mix, and the sand may cut and wash when the mold is poured.

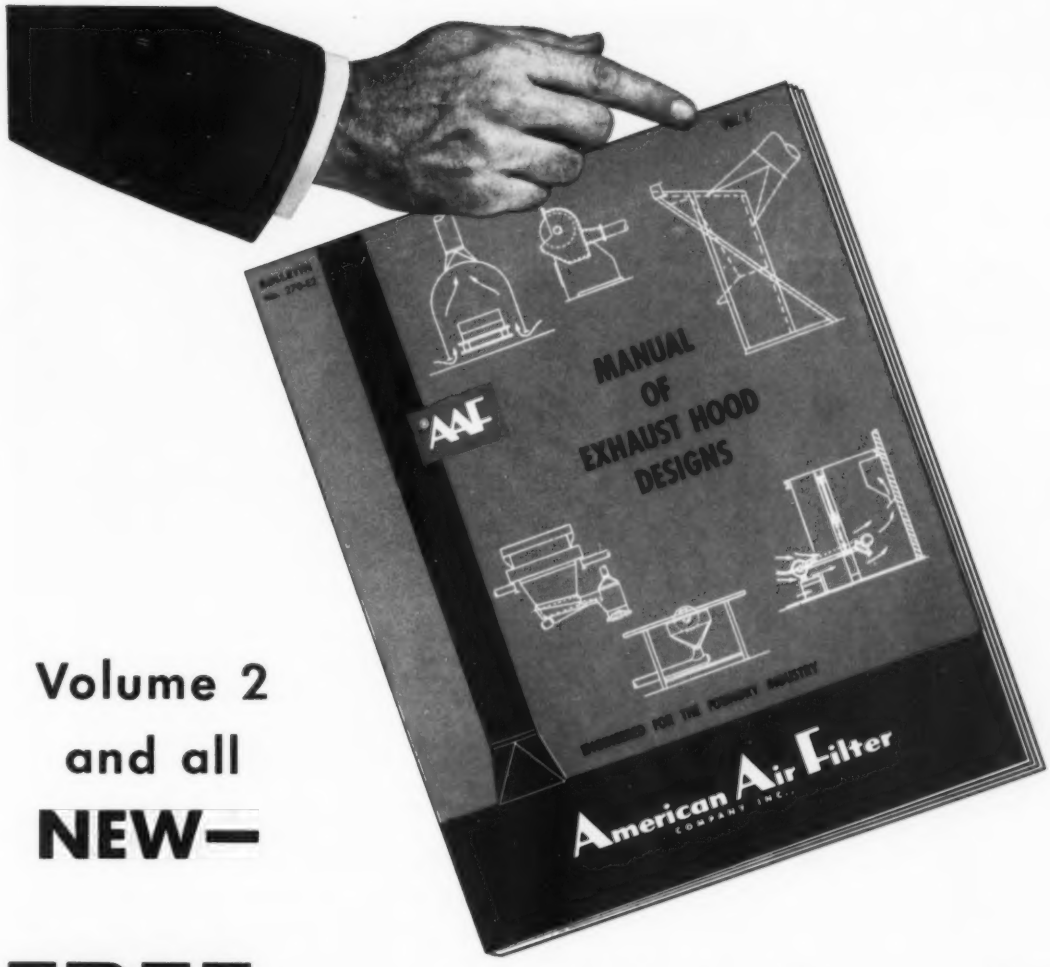
Also, too great a percentage of the colloidal bonding agent in the mix will absorb and hold too much moisture, which will decrease the efficiency of the bond.

If old sand is being used, fines may soak up the moisture, so that proper distribution of the moisture to the bonding material is not possible.

Too much moisture content will also cause all of the evils known to the foundryman, such as blows, buckles, burn-in, drops, sand inclusions, and scabs and many of the other problems.

Good foundrymen realize that one of the best ways to insure good castings is to add the best quality bentonite bonding agent to the mold mix, in the proper proportions recommended for the green, dry and hot strength desired, and to see that the proper amount of temper water is evenly distributed throughout the mix.

3903



Volume 2
and all
NEW—

FREE manual for Foundries

Presenting proven methods for increasing efficiency of Dust Control Systems

Here's a "must" for foundrymen who want facts. It's the second in the series, Volume 2 of AAF's Manual of Exhaust Hood Design — a complete engineering reference on hood designs and applications for foundry dust control systems. Twenty-eight pages of basic data; tables of exhaust requirements; dust concentrations and weights of collected material; hood sketches; and over 60 foundry installation photos. Special sections include:

- Snagging and Portable Grinding
- Swing Frame Grinding
- Abrasive Cleaning
- Melting Furnaces
- Sand Handling
- Shakeouts

A copy of this new Manual of Exhaust Hood Design is free for the asking. No obligation—just fill out and mail the coupon today.

American Air Filter
COMPANY, INC.
104 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.
Pacific Division Office, San Francisco, California

American Air Filter Company, Inc.
104 Central Avenue
Louisville 8, Kentucky

Please send me your new Manual of Exhaust Hood Design, Volume 2.

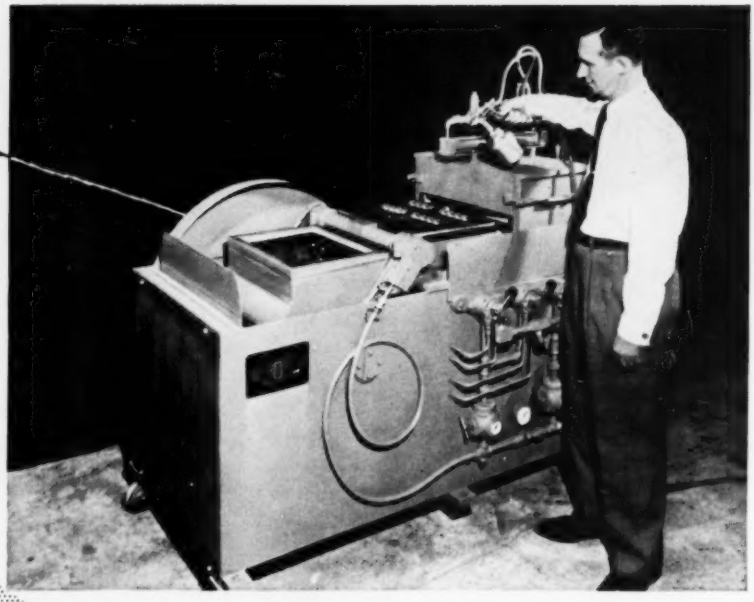
NAME_____

TITLE_____

COMPANY_____

CITY_____ STATE_____

CUT SHELL MOLDING COSTS



Shell-O-Matic Corporation's President E. H. Rubovitz of Newark, New Jersey, demonstrates pattern-spraying technique with Dow Corning 7 Emulsion. The mobile, economical Shell-O-Matic requires only 18 square feet of floor space to put precision sand shell molding on a shell-a-minute production basis. Compact and self-contained, the unit features a built-in air compressor, strip pattern heaters, an infrared curing oven and automatic shell ejector. Maximum shell capacity: 12"x18"x6".

use

DOW CORNING 7 EMULSION

. . . the silicone parting agent that assures clean, positive release of shell molds and cores at minimum cost.

Whether you're using manual equipment or a machine for maximum production economy, you'll save money by specifying Dow Corning 7 Emulsion to give fast, clean release of resin bonded, sand shell molds. This noncorrosive, nonflammable silicone emulsion cannot break down at molding temperatures to leave a carbonaceous deposit on even the most complex patterns.

That reduces your pattern cleaning costs to a minimum; gives you faster, more continuous production of shell molds with uniformly high dimensional accuracy. And that enables you to deliver what the metal working industry has learned to expect of the shell process; finished parts with a minimum amount of machining.

Easily diluted with water to any desired concentration, Dow Corning 7 Emulsion is safe, easy and economical to use. For more information and a free trial sample, fill in and mail this coupon today.

Send for sample TODAY

DOW CORNING CORPORATION, Dept. AV-3
Midland, Mich.

Please send me
- ☐ Free sample of Dow Corning 7 Emulsion
- ☐ Data on Silicone Release Agents for the Shell Process

NAME _____

COMPANY _____

ADDRESS _____

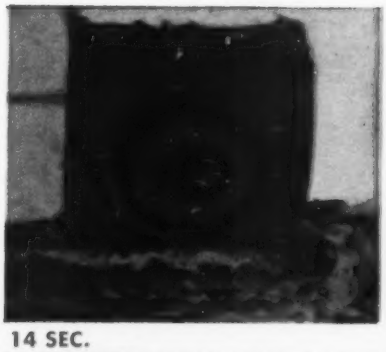
_____

DOW CORNING DOW CORNING SILICONES **CORPORATION**
MIDLAND MICHIGAN

ATLANTA CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.
In Canada: Fiberglas Canada Ltd., Toronto In Great Britain: Midland Silicones Ltd., London

OUTSTANDING CUPOLA CAST IRON DEOXIDIZER!

New FERROCARBO patented Briquette disperses completely in 57.5 seconds



14 SEC.

29 SEC.

36 SEC.

43 SEC.

50 SEC.

57.5 SEC.

Here's dramatic proof, in actual film sequences, that FERROCARBO Briquettes are truly *effective* in deoxidizing cupola iron. Rapid, controlled disintegration of FERROCARBO Briquettes is *complete* in the melting zone. 100% dispersion of the briquette throughout the metal means a thorough reaction in the cupola. You can't match FERROCARBO Briquettes for uniform cupola operation . . . for castings that are cleaner, more uniform, easier to machine. No wonder nearly 600 leading foundries are deoxidizing their cast and malleable iron with FERROCARBO Briquettes!

FERROCARBO

TRADE MARK

Briquettes by CARBORUNDUM

PHONE OR WRITE THE FERROCARBO DISTRIBUTOR NEAREST YOU

KERCHNER, MARSHALL & CO.
PITTSBURGH • Cleveland • Buffalo
Philadelphia • Birmingham • Los Angeles

MILLER & COMPANY
CHICAGO • St. Louis • Cincinnati

WILLIAMS & WILSON
TORONTO • Montreal • Windsor

"Carborundum" and "Ferrocarbo" are trademarks which are registered in the U. S. by The Carborundum Company, Niagara Falls, New York, and in Canada by Canadian Carborundum Company, Ltd., Niagara Falls, Ontario.

84-56

" . . . We cut our cleaning
room costs between 50 and 60 percent
as a result of using
Delta GraKoat Wash."

DELTA GRAKOAT CORE AND MOLD WASH

Delta GraKoat Core and Mold Wash speeds production of finer-finished castings.

Delta GraKoat Wash is moisture proof. When thoroughly dried, it will not absorb moisture. It will not precipitate when properly mixed and will stay in suspension indefinitely. It will not deteriorate. It is highly refractory. Molten metal lays on the surface without the least disturbance. It has high fusion and unusually high hot strength. There is no fusion or sinter below 3300° F. The hot strength is over 600 p.s.i. It does not react with molten metal to form gaseous vapors.

Delta GraKoat Wash anchors itself to the surface by penetrating into the sand. This prevents flaking, peeling, and scabbing when in contact with molten metal. It is easy to apply. It can be dipped, sprayed, swabbed, or brushed on either green or dry sand surfaces. Casting surfaces are free from burn-in and metal penetration and require a minimum amount of cleaning.

Delta GraKoat Wash covers a greater surface area and is much more economical to use. It is recommended for gray iron, malleable and non-ferrous castings.

A liberal working sample is available without cost or obligation together with complete instructions for use. Write today.

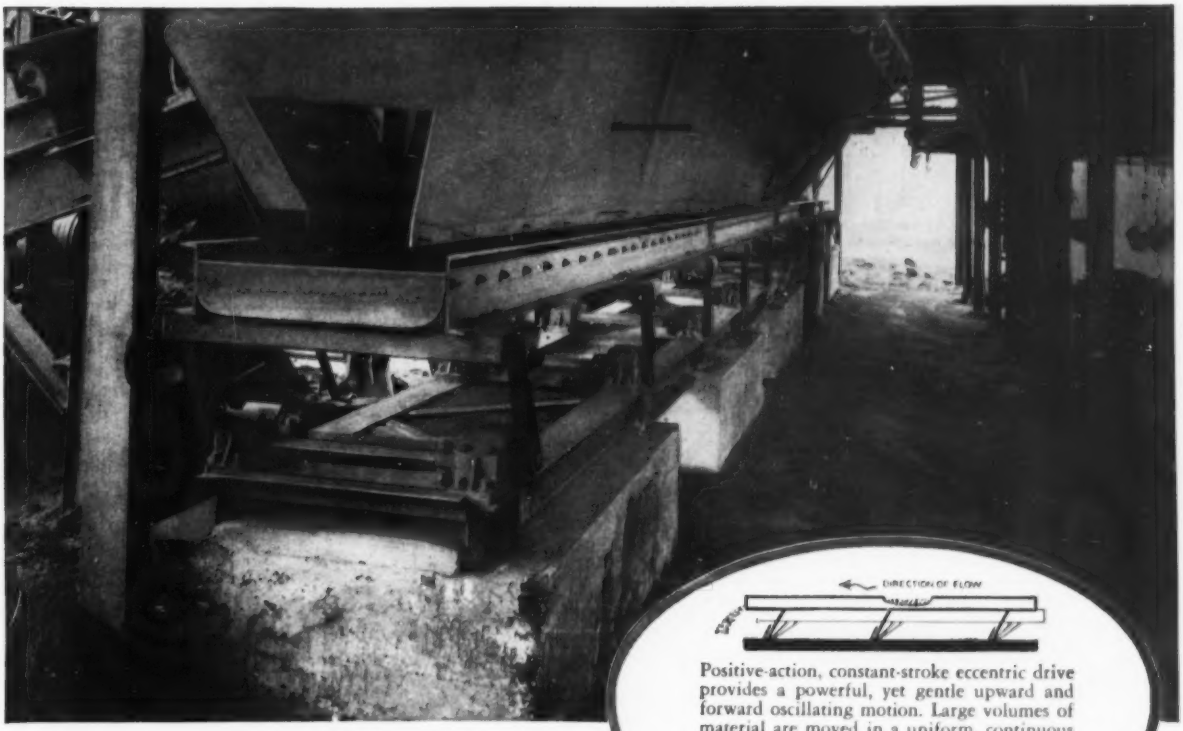
DELTA

DELTA OIL PRODUCTS CO.

MANUFACTURERS OF SCIENTIFICALLY CONTROLLED FOUNDRY PRODUCTS

MILWAUKEE 9, WISCONSIN

LINK-BELT Oscillating Conveyors pay for themselves in one year's maintenance savings!



Using oscillating conveyors, Lakey Foundry requires fewer handling units. Both conveyors in service are 30 in. wide. The one shown here is 90 ft. long. The second is 55 ft. in length, with a screening section to separate and reclaim rods, gates and sprues, from sand.

Positive-action, constant-stroke eccentric drive provides a powerful, yet gentle upward and forward oscillating motion. Large volumes of material are moved in a uniform, continuous flow, regardless of surges. Natural frequency spring action reduces power requirements to a minimum.

Lakey Foundry eliminates costly shutdown time and manhours handling hot sand and sprues

FOR many years Lakey Foundry, Muskegon, Mich., has had the problem of handling refuse, clean up sand and rods, gates, sprues and hot core sand. They attempted to solve this problem with other equipment which proved messy and costly. The installation of two all-metal, positive-action Link-Belt Oscillating Conveyors proved to be the answer.

Not only have the conveyors ended the frequent expensive shutdowns formerly experienced, costly jams have been eliminated. The modern, jamproof operation saves maintenance costs that each year approximated the new conveyors' price.

Foundries all over the country are switching to Link-Belt Oscillators. These minimum-maintenance, long-life conveyors are ideally adapted to handling hot sand and castings. Their compactness saves valuable space. And they can easily be made dust-tight if desired.

Yes, on many counts, Link-Belt positive-action Oscillating Conveyors are years ahead. For full details, contact your nearest Link-Belt office or write for new Book 2444.

LINK-BELT

CONVEYORS AND PREPARATION MACHINERY

FEMA

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities.

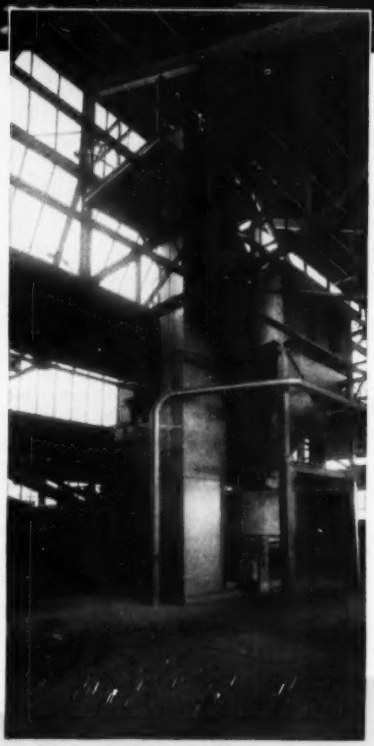
COMPLETE SAND HANDLING SYSTEMS

planned
designed
fabricated
installed
serviced

BY
NEWAYGO
ENGINEERING CO.

A complete sand handling system. Shakeout sand elevator, overhead storage, and mullers in background. Conditioned sand is delivered to overhead molding hoppers. Completed molds are set out on gravity conveyors for pouring from overhead monorail cranes. System handles 60 tons of sand per hour.

This unit is the heart of a sand handling system. Elevator carries shakeout sand to screen and bin conditioning unit. Sand passes into muller in batches as required. Prepared sand is delivered by conveyor to molding hoppers. This unit is designed for large or small systems.



are you planning a new or improved

SAND HANDLING SYSTEM?

Here are 4 important reasons why the NeWay plan is the right way and profitable way to modern, efficient, low-cost sand handling:

- *Free engineering* layouts, service and estimates *by practical engineers.*
- Single contract efficiency with one company responsible for fabrication, installation and erection.
- A complete staff of *service engineers* on 24 hour call.
- A 40-year record of proven ability.

NEWAYGO ENGINEERING COMPANY

NEWAYGO, MICHIGAN

ALSO MANUFACTURERS OF: The revolutionary new *Handy Sandy* and *Reddy Sandy*, complete package units for smaller installations. Write for literature.

Letters to the editor

All letters of broad interest which do not violate A.F.S. policy or good taste are publishable. Write to Editor, American Foundryman, 616 S. Michigan Ave., Chicago 5, Ill. Letters must be signed but will be published anonymously on request.

Why it looked homemade

The January issue of AMERICAN FOUNDRYMAN carried an article entitled *"Automatic Fume Collection Solves Air Pollution Problems"* which was read with much interest by our engineers. This article is further proof that corrective equipment is available to meet any requirement. The authors should be complimented for their very fine article which should be of interest to all foundrymen.

The "homemade" baghouse referred to in this article obviously is the first unit our company built and the reason it looked homemade is that it *was* homemade. It was built on the site by an engineer who was assigned to this project with instructions to build a collector that would meet the code for Los Angeles county. The existing wet washer, which could not meet the code was reworked to serve as a cooling chamber to reduce the temperature of the stack gases to approximately 500 F. This cooler was later removed from the stack and a different type is now used.

We now have 20 installations in Los Angeles county, all approved by the Los Angeles Air Pollution Control District.

We would also like to explain that a manual bag-shaking mechanism was supplied, not because of the brittleness of the fibre glass bags, but because we were making every effort to keep the cost of the baghouses as low as possible. Automatic shaking is available for baghouses using fibre glass bags.

C. MC GLONE, *Manager*
Cupola & Acc. Dept.
Whiting Corp.
Harvey, Ill.

Sold on foundry industry

I am one of those young men that Earl Strick had in mind when he wrote *"How to Encourage Young Men to Enter the Foundry"* which was in the November issue of AMERICAN FOUNDRYMAN (page 81). I became interested in the foundry industry while carrying my dad's lunch as a kid. I wanted to be just like dad. Today, he is my foreman —I am his assistant.

That doesn't mean I had things too easy. I started in the foundry sweeping floors, cleaning up the foundry, and running the buggy—carrying metal. Since then I have worked at furnace tending, molding, cleaning castings, inspecting castings, making cores, keeping pattern records, grinding, polishing, and just about every minor job pertaining to a foundry.

I consider myself fortunate because of this complete on-the-job training, and because I'm able to attend local and neighboring foundrymen's meetings. I also attended the A.F.S. Convention last spring in Atlantic City.

To further show my interest and ability to learn to my father and the company management, I know I have to have faith in my work, my boss, and my employer. I take every opportunity to analyze information, conversation, and literature that I come into contact with. For example, the assistant general manager asked me to attend a lecture on work simplification. I did and found it very interesting, gaining not only many useful ideas, but also learning that work simplification is the foreman's job.

I am studying 19 subjects and also buy and study all material and texts that the American Foundrymen's Society publishes pertaining to non-ferrous metal founding.

If I can interest myself in the foundry industry through merely carrying my father's lunch to work without any outside inducement to come along in the trade, think what a program of training and movies such as Mr. Strick recommends can do for young men!

I hope some day I'll be qualified to speak for the foundry industry in my own particular field and that I can contribute a little something to the progress of the industry.

HAROLD F. HIRSCHEL, JR.
Allentown, Pa.

Says light metal article good

We feel that the article *"Advantages and Disadvantages of Light Metal Melting Equipment"* by Hiram Brown of Solar Aircraft Co., which appeared in the December issue (page 36), is one of the best of this type we have seen in a long time. We'd like reprints.

RALPH RATHYEN
Joseph Dixon Crucible Co.
Jersey City, N. J.

Glad to send tear sheets

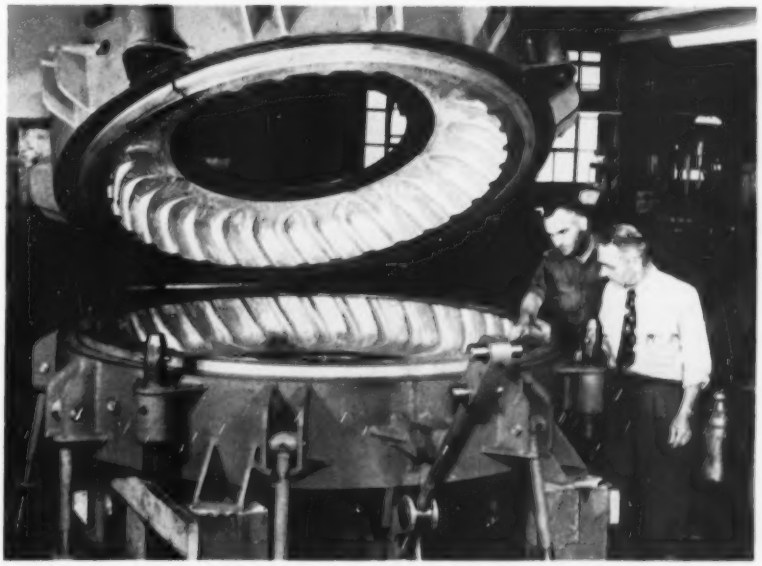
I read with interest the article on *"Advantages of Insulating an Electric Furnace Roof"* by Charles C. Spencer, Electric Steel Castings Co., Indianapolis, Ind., in the February issue of AMERICAN FOUNDRYMAN.

If you can conveniently furnish six copies of this article I would greatly appreciate receiving them.

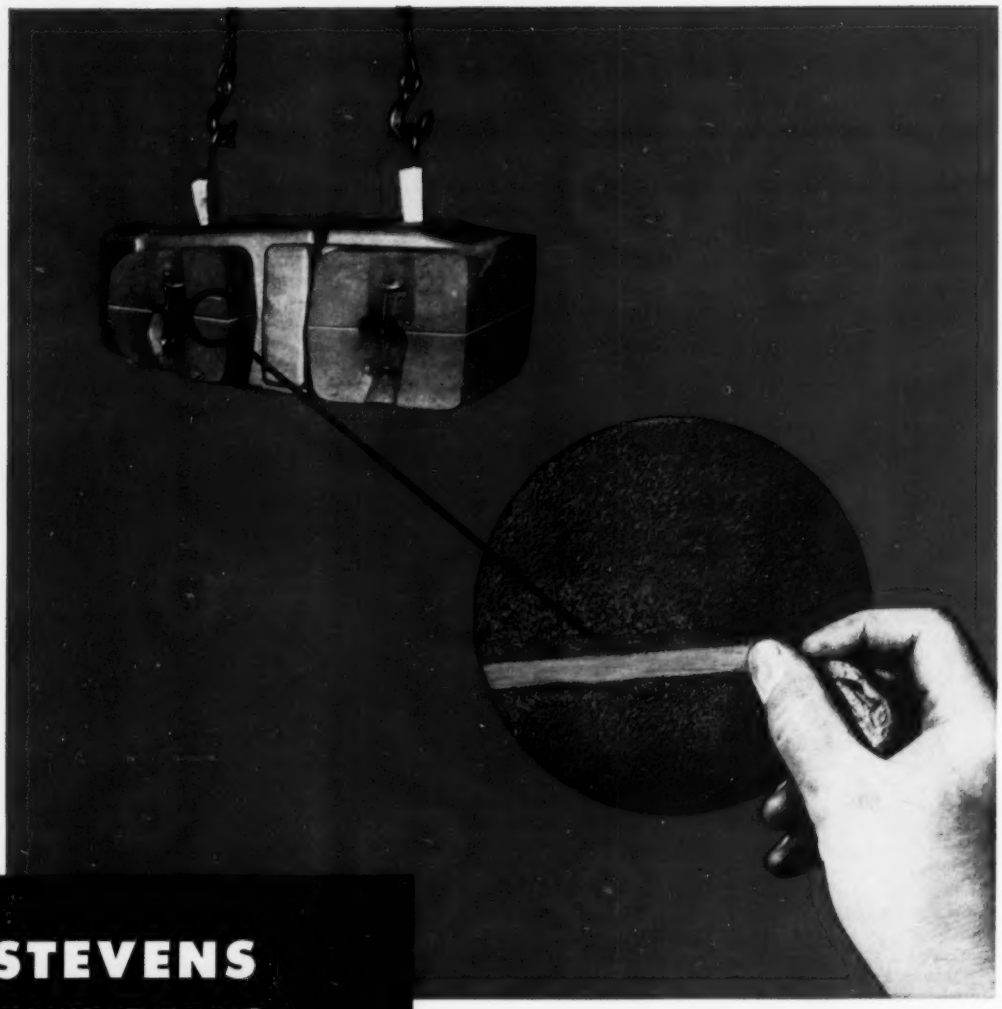
G. L. MEMORY, *V. P. & Gen. Mgr.*
North American Refractories
Ltd., Hamilton, Ont., Canada.

Tear sheets have been sent.

▶ Cast huge aluminum tire mold



Cast aluminum mold for 18.00 x 32-in. tire made in a foamed permeable plaster mold by James C. Heintz Co. of Cleveland. Use of plaster instead of a sand mold markedly reduces "buzzing" (cleaning) time. Rubber inserts make re-entrant angles in plaster mold possible.



STEVENS MUDDING COMPOUND....gives perfect results in unskilled hands

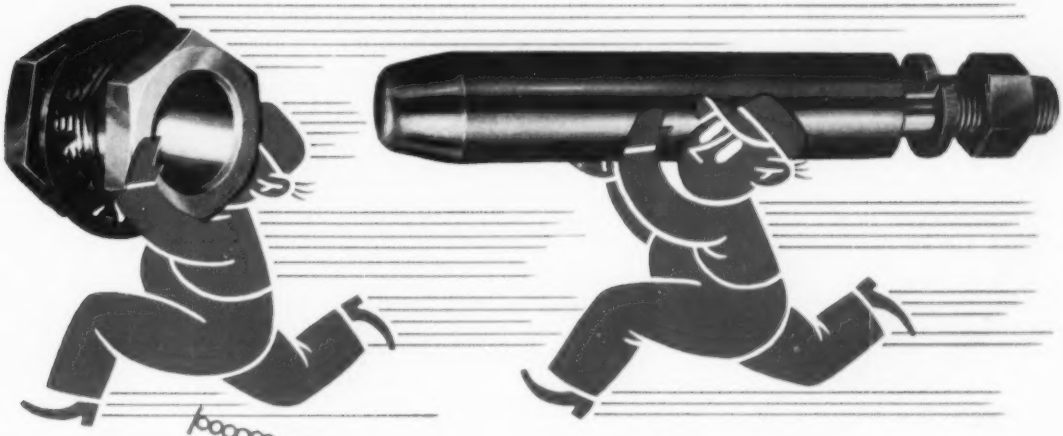
Your core workers will like the way Stevens Slick-Seal Mudding Compound always goes on smooth and easy. There's no crumbling, rolling or balling up behind thumb or finger. They'll like the way either black or white Slick-Seal easily washes off their hands with just plain water.

This new compound remains plastic and workable. Yet light applications of Slick-Seal dry in one to two hours; heavier applications in four to five hours. Edges won't shrink or curl when subject to oven heat . . . flowing metal won't dislodge Slick-Seal. Stevens mudding compound is a high heat resistant facing. It prevents fins or burn-in at pasted joints.

Why not order Slick-Seal Mudding Compound today? Call your Stevens representative or write direct. Frederic B. Stevens, Inc., Detroit 16, Michigan.

FREDERIC B. STEVENS INCORPORATED
EVERYTHING FOR A FOUNDRY

BRANCHES: **DETROIT • BUFFALO • CLEVELAND • NEW HAVEN • • INDIANAPOLIS**
IN CANADA: **FREDERIC B. STEVENS OF CANADA, LTD., TORONTO • WINDSOR**

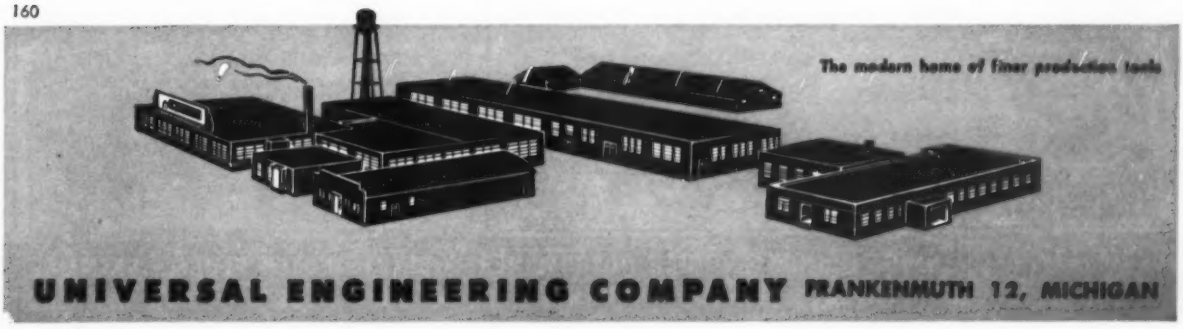


YOU SAVE TIME WITH UNIVERSAL

THREADED FLASK PINS AND BUSHINGS

Universal Flask Pins and Bushings save precious minutes of production time because they assure instant, accurate alignment of cope and drag. And they also save down-time because, being heat-treated and precision ground from fine quality steels, they stand up under rough treatment and give long, satisfactory service. Universal threaded series Flask Pins and Bushings are used in steel, aluminum, magnesium or other light metal flasks. Bushings are available in both the round and elongated types; pins in both round and hexagonal types. Universal carries a complete line of sizes of its threaded series as well as its taper and plain series Pins and Bushings as regular stock items. For further information write to the Universal Warehouse nearest you — 1060 Broad St., Newark, N. J., 5035 Sixth Ave., Kenosha, Wisc., or the home office.

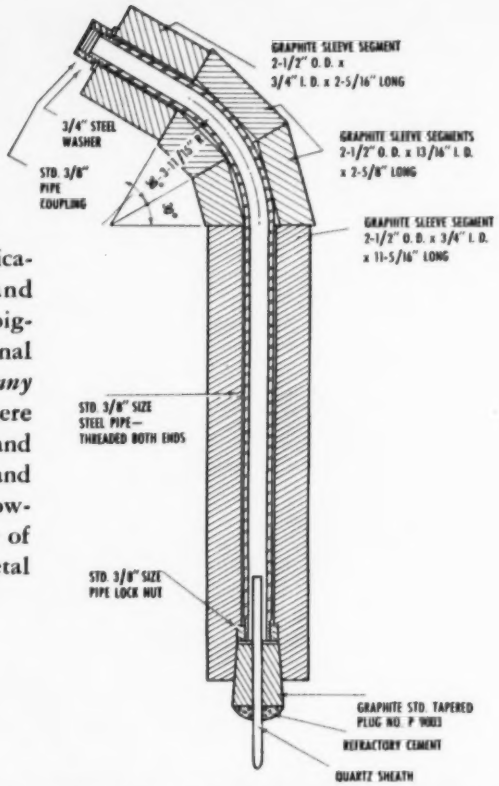
160



In Furnace and Foundry...

These SMALL PARTS do a BIG JOB

● High temperature applications of "National" Carbon and Graphite are not limited to big-tonnage items. A part of National Carbon's service is to develop *any* application, however small, where the unique properties of carbon and graphite assure a convenience and economy to the user. In the following two instances, a few *pounds* of graphite serve literally *tons* of metal . . . efficiently and at a saving.


GRAPHITE SLEEVE SEGMENT 2-1/2" O.D. x 3/4" I.D. x 2-5/16" LONG
3/4" STEEL WASHER
STD. 3/8" PIPE COUPLING
GRAPHITE SLEEVE SEGMENTS 2-1/2" O.D. x 13/16" I.D. x 2-5/8" LONG
GRAPHITE SLEEVE SEGMENT 2-1/2" O.D. x 3/4" I.D. x 11-5/16" LONG
STD. 3/8" SIZE STEEL PIPE— THREADED BOTH ENDS
STD. 3/8" SIZE PIPE LOCK NUT
GRAPHITE STD. TAPERED PLUG NO. P 9003
REFRACTORY CEMENT
QUARTZ SHEATH

"NATIONAL" GRAPHITE FLUXING TUBES

Can't be equalled by any other material for the introduction of purifying gases into molten metal. Graphite tubes won't melt in the bath, can't contaminate the metal. Its low coefficient of expansion prevents cracking and spalling. Metal and dross do not adhere tightly to it. And whatever gases are used, graphite will not corrode.

"NATIONAL" GRAPHITE-SHEATHED THERMOCOUPLE ASSEMBLY (Typical)

Only graphite could provide the degree of low-cost, trouble-free protection required by thermocouple assemblies of this type for the immersion method of measuring open hearth and electric furnace bath temperatures. Reclamation and maintenance for re-use are simple, quick, and economical. Molten metal won't stick to the graphite parts and they're immune to thermal shock.

HERE'S HOW TO LICK HY HEET

National Carbon Company
30 E. 42nd Street
New York, N. Y.

PLEASE SEND INFORMATION ON:

☐ Thermocouple Sheath Parts ☐ Fluxing Tubes

NAME_____

COMPANY_____

ADDRESS_____

The terms "National" and "Eveready" are registered trade-marks of Union Carbide and Carbon Corporation

NATIONAL CARBON COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, New York
District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco
IN CANADA: National Carbon Limited
Montreal, Toronto, Winnipeg

LOW LIGHT BILLS . . .

. . . mark phenomenal acceptance of "EVEREADY" No. 1050 Industrial Flashlight Batteries by a broad cross-section of industry. Delivering twice the usable light of any battery we've ever made before, it will not swell, stick or jam in the flashlight . . . has no metal can to leak or corrode.

BLAST FURNACE LININGS • BRICK • CINDER NOTCH LINERS • CINDER NOTCH PLUGS • SKIMMER BLOCKS • SPLASH PLATES • RUNOUT TROUGH LINERS • MOLD PLUGS • TANK HEATERS

products and processes

For additional information, use postcard at bottom of page 17

Potentiometer

Portable indicator spots impending thermocouple failures, tests operation of other pyrometer instruments, and checks heating units and test furnaces which may not warrant continuous measurement. Weighs only 14 lb. and measures 9¼ in. x 9¼ in. x 6¼ in. Unit has 17 in. scale, which permits reading with accuracy of ¼ of 1 per cent. *The Foxboro Co.*

For more data circle No. 1 on card, page 17

Safety goggle

Model "707" safety goggle has acetate frame designed to retain the safety lens under severe impact. Wire core temples have cable-wound ends for easy fit. Product features wide-flaring nose pad, flesh tint, high-line temples, keyhole bridge and drop-eye shape. *Pennsylvania Optical Co.*

For more data circle No. 2 on card, page 17

Shell molding machine

The Mark IV, a semi-automatic shell-molding machine (see photo) handles pattern plates in sizes up to 13 x 20 in. Average rate of output is one complete mold per minute. Rate can be regulated (up or down) about 20 per cent by handwheel at the base. Machine has four stations, one at front and three in the oven. Features positive ejection of mold convenient to operator's hand. Measures 72 in. diameter by 51 in. to crown of oven. All mains can be brought up beneath the machine. *Polygram Casting Co. Ltd.*

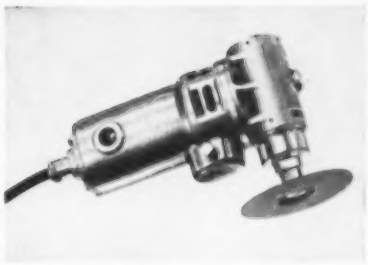
For more data circle No. 3 on card, page 17

Refractory saw

Clipper Model HD masonry saw incorporates "pressure-equalizer spring"

"Dustless" refractory saw has safety-lock.

which automatically cushions the blade, giving longer blade life. Cutting head can be adjusted to any desired height. Factory-sealed water pump permits either wet or dry operation. Patented "Hinge-Lok" blade guard serves as a safety device and eliminates water spray when wet cutting. "Dustless" features make it possible to operate saw next to the job—or even inside the furnace. Cuts any of the difficult intricate shapes —end skews, keys, splits, soaps, wedges —needed for furnace, kilns, and boilers. *Clipper Mfg. Co.*



Portable hand tool for high-speed finishing.

For more data circle No. 4 on card, page 17

High speed hand tool

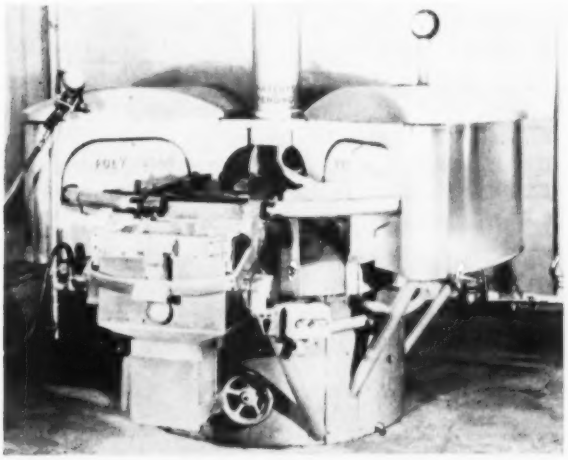
B-2 Diskette is portable electric hand tool for high speed grinding, filing, deburring, sharpening, sanding, polishing and other preparation and finishing jobs. Operates at higher speeds than conventional electric tools, with capacity limited to a 4 in. disc. A Universal 110-120 V. motor, AC or DC, gives spindle shaft a no-load speed of approximately 9000 rpm. *Franklin Balmar Corp.*

For more data circle No. 5 on card, page 17

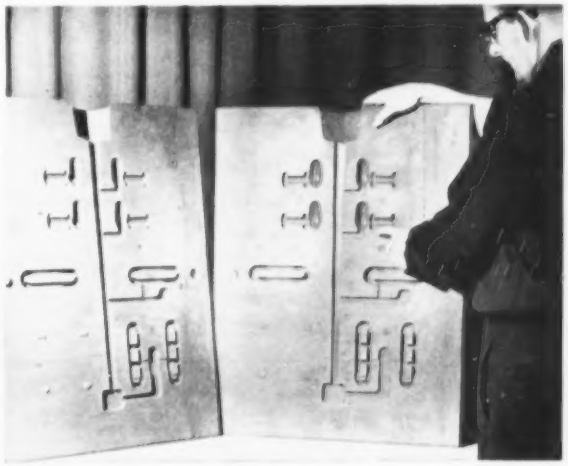
Magnetic drum

Magnetic drums used for removal of tramp iron and medium-fine ferrous contamination from conveying systems now incorporate these improvements: changeable sheave sizes for various operating speeds; stainless steel shells that resist pitting and corrosion; dust-tight construction; lightweight, rigid, cast

continued on page 17



Semi-automatic shell molding machine has one-minute variable cycle.



Shell mold bonded with General Electric S-1054 (also see page 17).

Tenn-sil in the sand means quality in the castings

Tenn-Sil, additive to foundry sand, improves the quality of the end product and reduces the danger of casting defects.

Tenn-Sil No. 1 . . . *Reduces expansion and, by increasing hot deformation, acts as a cushioning agent in the elimination of rat tails, buckles and certain types of scabs. It is also useful for insulating hot metal when delays in pouring occur.*

Write for test report T- 3028 for further details.

Tenn-Sil No. 2 . . . *Constitutes a specific improvement over Silica Flour for core-room operations and steel facing sands inasmuch as it is a neutralized high Silica compound containing no free Silica and therefore offers no silicosis hazard to the operators.*

For properties of facing sands containing Tenn-Sil No. 2 write for test report T-3070.

TENNESSEE
PRODUCTS & CHEMICAL
Corporation
NASHVILLE, TENNESSEE

products and processes

continued from page 15

aluminum sides; adjustable feeder assemblies; oil-sealed bearings, and extended discharge ducts. Available in two models with or without housing, DF101 (12 in.) and DF-102 (18 in.). *Eriez Mfg. Co.*

For more data circle No. 6 on card below

Heat resistant gloves

Made of soft leather impregnated with insulating material, Liberty Heat Gloves are said to resist temperatures up to 800 degrees. An inner lining of soft leather is sewn into the finger tips to prevent separating when gloves are removed from perspiring hands. Inseam construction protects threads from excessive wear. Also available are mitts, of similar construction, which can be worn on either hand. *Liberty Dressing Co.*

For more data circle No. 7 on card below

New blow ring design

Designed for the Aeroturn dust collector, new blow ring incorporates self-adjustment features. Each ring is made in two half sections which are mounted on the carrier by two flexible rubber tubes. In dimensional changes (filter bag shrinkage or stretching) blow ring is held in contact with felt surface. Ring carrier assembly is mounted to float laterally, accommodating vertical alignment of filter bags under all conditions. Use of cast aluminum in place of steel-welded fabrication, reduces weight of unit by more than 50 per cent, increases the durability and strength. *Turner & Hawe Engineering Co. Inc.*

For more data circle No. 8 on card below

Improved resin

New resin (Lustrex 886) eliminates clay balls from foundry sand. Effective even in small concentration (one pound of the material produces uniform clay distribution in one ton of foundry sand.) Foundry tests indicate sand treated with the resin will help upgrade castings of steel, malleable iron, grey iron, phosphor bronze, aluminum and magnesium. *Monsanto Chemical Co.*

For more data circle No. 9 on card below

Synthetic combination

Four-in-one "foundry package" includes S-1054, a new phenolic resin binder, and SM-155 silicone parting agent to release shell molds from patterns. Offered together with G-E 12353 liquid core binder resin and G-E 3255 permafil for impregnating porous castings. These comprise all necessary synthetics for shell molding as well as regular sand casting. Application assistance offered. *General Electric.*

For more data circle No. 10 on card below

Fork lift trucks

Models FTD50-24 (Diesel-powered) and FT-50-24 (gasoline-powered) fork lift trucks are rated at 5000-lb. capacity at 24-in. load center from heel to fork. Available in all standard heights of lift from 72 to 120 in. Trucks feature single-lever, full range gear shift; center point automotive type steering; full front vision instrument panel, hydraulic brakes; all roller rolled-steel mast; and self aligning lift cylinder. Unit is designed so it can turn in a 61-in. intersecting aisle. *The Buda Co.*

For more data circle No. 11 on card below

Powder cutting torch

Flame washing torch has been developed for quick removal of riser pads, chill bars, fins, etc. from stainless and other alloy steel castings. Said to be up to ten times faster than chipping and grinding. *National Cylinder Gas Co.*

For more data circle No. 12 on card below

Lubrication

New Alemite lubricator delivers a preset, constant shot of either oil or lubricant to trolley wheels on each side of a conveyor system, simply by the flick of a switch. As conveyor reaches spot where lubricator is installed, coupler clamps the lubricant fitting on its hub and delivers lubricant at pressure of from 800 to 1,000 lb. Amount of lubricant can be adjusted to .005 cu. in. *Stewart-Warner Corp.*

For more data circle No. 13 on card below

Reader Service Dept.

53|3

Please send me detailed information on the Products and Processes and Free Foundry Information circled.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50

★ Please print or type information below

NAME

TITLE

COMPANY

ADDRESS

CITY AND ZONE

Postage Will be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

First Class Permit No. 14680, Sec. 34.9 P. L. & R., CHICAGO, ILL.

Reader Service

AMERICAN FOUNDRYMAN

616 S. Michigan Avenue

Chicago 5, Illinois

free / foundry information

For additional information

use postcard at bottom of this page

High temperature lubrication

How "dag" colloidal graphite is used to lubricate kiln cars at 450 F, and oven conveyors up to 1200 F, and is described in new illustrated bulletin (No. 423). *Acheson Colloids Co.*

For more data circle No. 14 on card below

Cleaning system

Bulletin D-S, a 20-page, 2-color booklet, gives complete information on the Lamson Exidust central vacuum cleaning system. Diagrams and photos describe industrial commercial uses, name representative users. Sufficient engineering data included to enable reader to plan cleaning system in detail. *Lamson Corp.*

For more data circle No. 15 on card below

Electric furnace costs

Complete cost data are given in a new 8-page report, "The Electric Furnace in the Iron Foundry," indicating that electric furnace is an economical melter. Tables give estimated costs for electric energy, labor, maintenance, etc. *Whiting Corp.*

For more data circle No. 16 on card below

Metal cleaning

Bulletin shows how low-production operators can modernize cleaning rooms and cut costs by speeding cleaning operations. Case histories show savings up to 67 per cent after installation of described equipment. *American Wheelabrator.*

For more data circle No. 17 on card below

Furnaces

Photographs, diagrams and specification charts on all types of "Lindberg Super Cyclone" furnaces are given in 8-page 2-color bulletin (No. 131). Operation design features and uses for annealing, normalizing, tempering nitriding and special heating are briefly explained. *Lindberg Engineering Co.*

For more data circle No. 18 on card below

Dust filter

Illustrated bulletin (No. 528) deals with all aspects of dust control as achieved by the Hersey-type dust filter. Describes filtering efficiencies as high as 99.998 percent, ability to reclaim valuable product, and to separate dust from two or more exhaust streams within the same filter. Dimension charts, capacity ratings, diagrams and photos of specially engineered and installed layouts are presented. *The Day Co.*

For more data circle No. 19 on card below

Certified alloys

Brochure describing new service whereby precision casting foundries can obtain stainless, "super" stainless, and alloyed tool steels specifically developed for remelting purposes is now available. The brochure shows laboratories, melting equipment of latest design and other equipment used to produce quality alloys. *Cannon-Muskegon Corp.*

For more data circle No. 20 on card below

Test methods

Eighty different methods for testing, inspecting and analyzing some 90 different types of products are listed in folder prepared to show scope of services available for quality control. Emphasis is on facilities that make it possible to perform these services in the field or in the client's plant. *American Standards Testing Bureau, Inc.*

For more data circle No. 21 on card below

Metal analysis

An elaborate 222 page review of selected apparatus for metallurgical testing. Catalogs nearly 1000 items of laboratory equipment, giving brief descriptions and pictures in most cases. *Buehler, Ltd.*

For more data circle No. 22 on card below

Blast Cleaning

Four-page bulletin (No. 904) tells how airless blast cleaning can be used in

continued on page 109

Postage Will Be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

First Class Permit No. 14680, Sec. 34.9 P. L. & R., CHICAGO, ILL.

Reader Service

AMERICAN FOUNDRYMAN

616 S. Michigan Avenue

Chicago 5, Illinois

Reader Service Dept.

53|3

Please send me detailed information on the Products and Processes and Free Foundry information circled.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50

★ **Please print or type information below**

NAME

TITLE

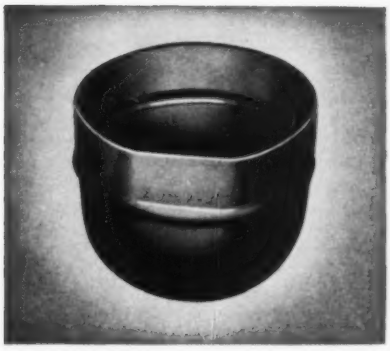
COMPANY

ADDRESS

CITY AND ZONE

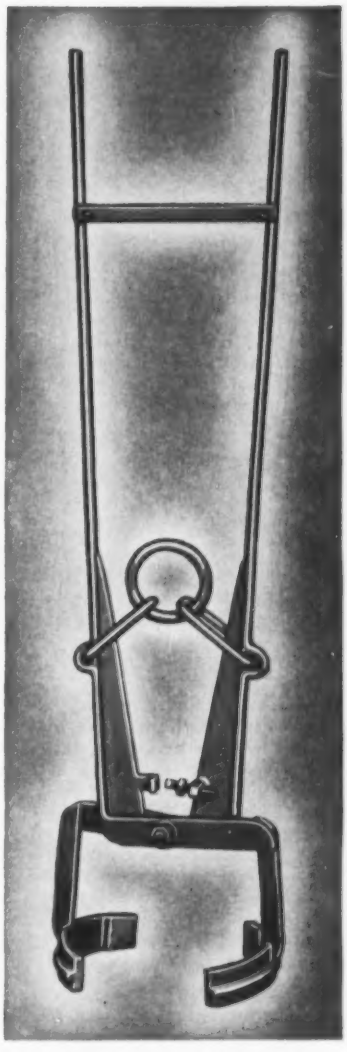
NO. 1 SOURCE FOR

Bowls · Shanks · Tongs

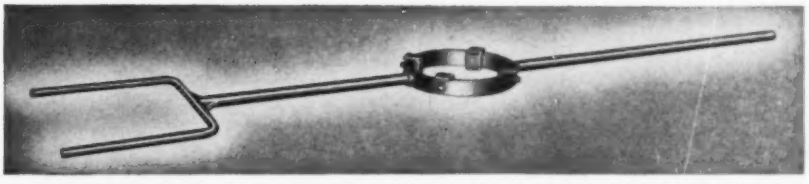


Industrial Equipment round bottom pressed steel ladle bowl, 50 lb. capacity, type 7 flat side.

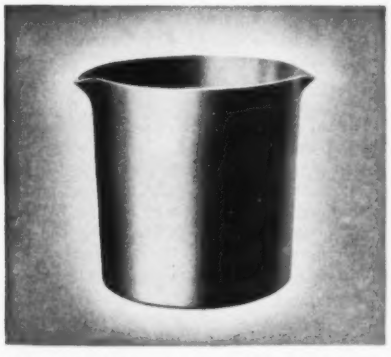
Industrial Equipment round bottom pressed steel ladle bowl, 60 lb. capacity, type 14 circular.



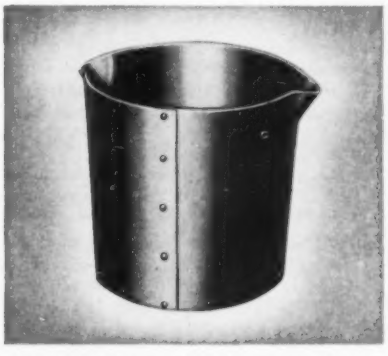
Type 72C crucible tongs. Adjustable. Four-point suspension. Claw types also available.



Industrial Equipment type 30CA single and adjustable ladle and crucible shank. Four-point suspension . . . easily adjustable . . . no springs . . . air cooled band. Fixed band types also available.



Industrial Equipment type 514 flat bottom welded steel ladle bowl. Available in almost any size or thickness.



Industrial Equipment 537 flat bottom riveted steel ladle bowl.

The above Industrial Equipment products, along with dozens of other types of bowls, shanks, tongs and ladles, are included in our latest catalog. *Write for your copy.*

LADLES

SHANKS

BOWLS

TONGS

Industrial

EQUIPMENT COMPANY

115 NORTH OHIO ST., MINSTER, OHIO

Advertisement

ELECTROMET Data Sheet

A Digest of the Production, Properties, and Uses of Steels and Other Metals

Published by Electro Metallurgical Company, a Division of Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. • In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

Deoxidation Studies Show Advantages of Silicomanganese

Silicomanganese has proved to be highly efficient and economical as a furnace block and deoxidizer, as well as an alloy addition. Steel producers have found that it saves furnace time, produces cleaner steel, and increases the yield of rolled products.

Excellent Blocking Addition

When used as a blocking addition, silicomanganese stops the carbon-oxygen reaction in the open-hearth furnace and permits close control of analysis. The alloy has a ratio of approximately 3.5 manganese to 1 silicon. This proportion will produce a high degree of deoxidation in the furnace.

Why Silicomanganese Is Effective

The carbon boil is arrested more positively by this combination alloy, containing both silicon and manganese, than it is by larger amounts of silicon alone. As a result, close control of the carbon level can be maintained. Also, because of the low carbon content of silicomanganese, the heat may be blocked at a comparatively high carbon level. This saves furnace time, which is critical in reducing costs. Since silicomanganese gets more oxygen out of the bath than silicon alone, the steel is cleaner and has improved surface quality.

Metallurgical Studies Made

Work done by Herty and his associates (1) showed that manganese tends to flux silica inclusions resulting from deoxidation, and permits them to grow in size so that they float out of the bath more rapidly.

More recently, it was found by Hilty and Crafts (2) that manganese and silicon in combination lower the oxygen content much more than silicon alone (see Fig. 1). They also determined that, although manganese by itself is not a strong deoxidizer, it substantially intensifies the deoxidizing power of silicon.

It was shown that in steels with lower silicon contents (below 0.05 per cent), manganese in the amounts usually present as a residual has a strong influence. However, in the silicon range normally used for deoxidation (0.05 to 0.25 per cent), more manganese is required to obtain the full benefit of the combined deoxidizers. For example, at 1600 deg. C, iron with 0.10 per cent silicon and 0.10 per cent or less manganese contains about 0.017 per cent oxygen. With 0.50 per cent manganese, it contains only 0.009 per cent oxygen (see Fig. 1).

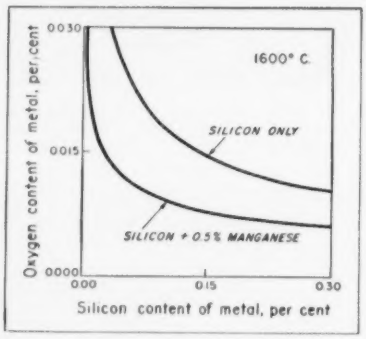


Fig. 1. Limit of solubility of oxygen in iron-silicon alloys, plain and with 0.50 per cent manganese at 1600 deg. Centigrade.

These data thus confirm an observation made by Tenenbaum and Brown (3) that steel as tapped from the furnace is materially lower in oxygen after blocking with silicomanganese.

In another study, made by Silliman and Forsyth (4) it was demonstrated that heavier than usual additions of silicomanganese result in a marked improvement in surface quality. About twice the usual addition of silicomanganese gives a substantial increase in the yield of finished product.

Silicomanganese Produces Cleaner Steel

Initial deoxidation in the furnace with silicomanganese produces very clean steel, particularly in grades below 0.25 per cent carbon. Several factors contribute to the cleansing action of silicomanganese. The amount of dirt in steel seems to be proportional to the maximum oxygen content prior to final deoxidation. Heats that are oxidized to a low carbon and recarburized, as were early rail and forging steels, are dirtier than those in which the carbon is "caught on the way down."

It is also well recognized that medium-manganese and low-carbon steels that are blocked at higher carbon (lower oxygen) contents, with low-carbon ferro-alloys, are cleaner than those taken to a lower carbon level and recarburized with high-carbon ferro-alloys. Silicomanganese is low enough in carbon to block at higher carbon levels. As pointed out by Tenenbaum (5), there is also a decided economic advantage in not driving to such low carbon contents before blocking.

Suitable For Ladle Additions

In addition to its use as a bath deoxidizer, silicomanganese has proved particularly effective as a ladle addition for the deoxidation of semi-killed steels. The alloy is also used to provide the complete ladle addition of manganese in the manufacture of medium-manganese, acid-steel castings.

Metallurgical Service Available

Our metallurgists will be glad to help you with the use of ELECTROMET silicomanganese. This alloy contains 65 to 68 per cent manganese, and is produced in maximum 1.50, 2.00, and 3.00 per cent carbon grades. All grades are furnished in a lump size of 75 lb. x 2 in. and in a crushed size of 2 in. x down. If you wish further information, please write, wire, or phone the nearest ELECTROMET office: in Birmingham, Chicago, Cleveland, Detroit, Houston, Los Angeles, New York, Pittsburgh, or San Francisco. In Canada: Welland, Ontario.

References

1. C. H. Herty, Jr., C. F. Christopher, M. W. Lightner, and H. Freeman: "The Physical Chemistry of Steelmaking; Deoxidation of Open-hearth Steel with Manganese-silicon Alloys," U. S. Bur. of Mines, Carnegie Tech. and Min. and Met. Advisory Boards, Coop. Bul. 58, 1932.
2. D. C. Hilty and W. Crafts, "The Solubility of Oxygen in Liquid Iron Containing Silicon and Manganese," Trans. AIME, 188, 1950, pp. 425-436.
3. M. Tenenbaum and C. C. Brown, "The Total Oxygen Content of Plain Carbon Open-hearth Steel During Deoxidation and Teeming," AIME 162, 685-705, 1945.
4. L. R. Silliman and H. F. Forsyth, "Deoxidation vs. Surface Quality," Open-hearth Proceedings, 32, 1949, pp. 218-224.
5. M. Tenenbaum, "The Economic Aspects of Deoxidation," Open-hearth Proceedings, 28, 1945, pp. 349-352.

The term "Electromet" is a registered trademark of Union Carbide and Carbon Corporation.

Veterans on the Production Front . . .

Still Rolling After 22 Years' Service!

Note the riveted fittings on the Sterling Rolled Steel Flasks shown in the above illustration! Outmoded? Yes, of course! But isn't it amazing how these steel flasks continue to produce castings? After 22 years of steady, dependable service, these old timers are still rolling down the conveyor line.

Naturally, today, Sterling Flasks are of all-welded construction, fabricated from special hot rolled channel steel — *not pressed steel*. This assures even greater rigidity and longer life. The heavy flanges, with square corners and full-width bearing and the solid reinforcing bar around each section, provide strength and rigidity to withstand tremendous pressures, year after year. Partings are accurately machined — not just surface ground, but planed to an accuracy of .005". The thick flanges have plenty of steel for several refinishings.

Have you received your copy of the new Sterling Booklet entitled "How to Select and Maintain Foundry Flasks"? Write for your copy.

Get the complete Sterling story. Write for copy of Foundry Equipment Catalog.

STERLING WHEELBARROW COMPANY
Milwaukee 14, Wisconsin, U.S.A.

A 7371-IPC

CONSIDER

GOOSE LAKE

FOR YOUR FOUNDRY

GOOSE LAKE refractories have been used by leading foundries in the midwest area for over 40 years.

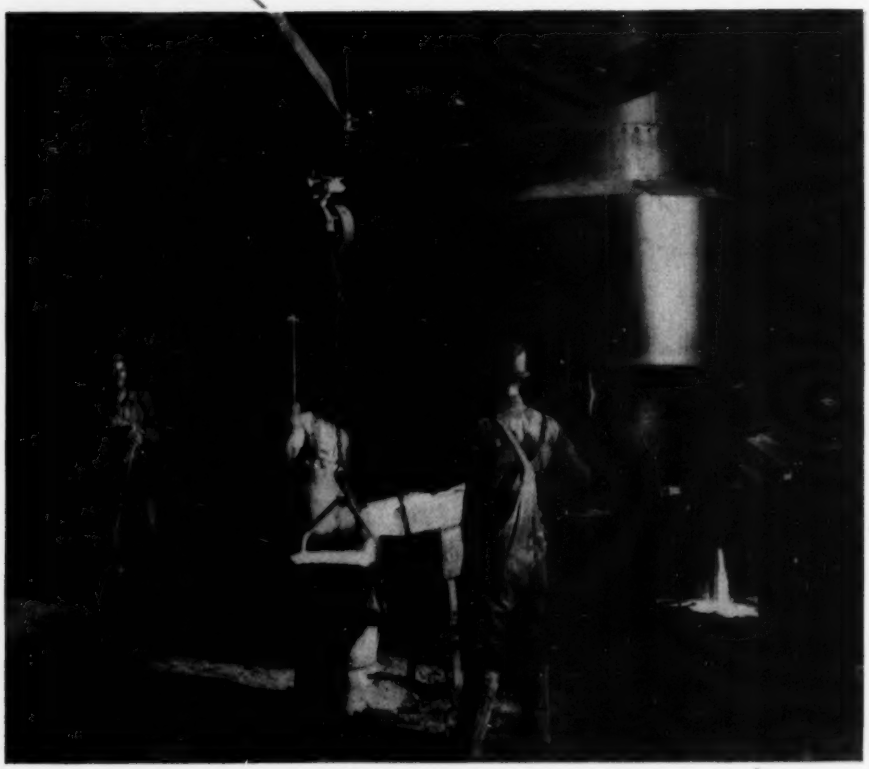
GOOSE LAKE FIRE CLAY BRICK are dry-pressed and de-aired assuring uniform dimensions and high density.

GOOSE LAKE GROUND FIRE CLAY, used extensively for mudding, daubing and brick laying, has adequate refractoriness and low drying shrinkage.

GOOSE LAKE FIRE CLAY FLOUR, a finely pulverized preparation, tempers quickly and is used extensively for bonding molding sands, to promote flowability, increase moisture range, and improve casting finish.

ILLINOIS CLAY PRODUCTS COMPANY

Chicago, Illinois • 208 South LaSalle Street
Joliet, Illinois • Barber Building



Write today for booklet giving complete information!

ANOTHER **FOUNDRY PRODUCT!**

Grundite Bond Clay for bonding molding sands—a newly developed and different clay for malleable and many grey iron castings. Contains "illite," an unusual, ceramic mineral.

talk of the industry

L. N. SHANNON, Stockham Valves & Fittings Inc., Birmingham, Ala., assumed the presidency of the International Committee of Foundry Technical Associations January 1. A past president of A.F.S., he has been "vice-president in charge" of the International Committee since the death of Dr. Guido Vanzetti of Italy early in 1952. Vice-president of the International Committee for 1953 is Achille Brizon, a past president of France's Association Technique de Fonderie.

ACID TO BASIC CUPOLA LINING in mintues has been achieved by a gray iron foundryman with the aid of an air placement gun. Interested in low sulphur iron, he sprayed a granular, basic refractory mix over his acid lining so he could run tests without the expense or delay of a complete relining job. Subsequently satisfied with results, he relined with basic brick.

MARKETS AFTER THE DEFENSE EXPANSION, a booklet recently released by the Department of Commerce can be obtained from the U. S. Government Printing Office, Washington 25, D.C. (send 55¢) or from local Commerce Dept. offices. An appraisal of business prospects for the next several years, the booklet includes such chapters as: Business Looks Ahead, Economy of Transition, Outlook for Government Purchasing, Consumer Market, Problem of Business Fluctuations, and Market Analysis.

YOU HAVE TO GIVE TO GET the most out of A.F.S. One way is through the technical committees which will be adding new blood soon for 1953-54. Committee appointments are made by the chairman of the committee—not by A.F.S. Headquarters or any individual staff member. This is the democratic way and assures that the work of the committees will be carried on by men who volunteer their services. Committee service provides for personal exchange of ideas with the foundry industry's top operators and technicians. Any foundryman who feels he has something to contribute to the knowledge of the industry, and is willing to attend meetings when called, should do this: Write to American Foundrymen's Society, 616 S. Michigan Ave., Chicago 5, Ill. . . request a copy of the National Committee Personnel roster . . . pick out the committee on which he feels best qualified to serve . . . write the committee chairman. Failure to attend at least one meeting a year of any committee is cause for removal. A.F.S. pays expense of attendance at any regularly-called committee meeting (except when held during Convention) if expense account is submitted.

LOWER REARMAMENT COST through study of U.S. foundry techniques is the aim of five specialists from Portugal's Braco de Prata arsenal. Sponsored by the Mutual Security Agency, the visitors are spending three months here studying production of steel and non-ferrous castings, heat-treating, material handling, and machining methods.

THEY APPLY EQUALLY WELL TO A.F.S. or to any other progressively-minded organization, these words to members of the Council of Iron-foundry Associations from Council Chairman Noel P. Newman. A past president of the Institute of British Foundrymen, he stated recently: "There is no finality in the development of an industry. Something new is always happening. At all times, there is ample scope for every ounce of active aid from the individual member. My most earnest hope for 1953 is that more and more of the vigorous, thinking men in our industry shall join in the work we do. If they come forward in greater numbers, they will most effectively help both their fellow-ironfounders and themselves."

leading foundries

select

COLEMAN

There is a Coleman Oven to help give you maximum production on every core baking or mold drying job—regardless of the size and shape of your castings. Coleman Ovens in leading foundries from coast-to-coast are proving vital in increasing casting tonnage at low cost...with less man power!

It will pay you to investigate how Coleman Ovens can solve your baking and drying problems. Our 50 years of engineering experience is available without obligation.

BAKING AND DRYING TIME REDUCED regardless of size and shape of cores and molds, increasing turnover of plates, dryers, and flask equipment.

MOST EFFICIENT HANDLING METHODS for your type of work and plant conditions...eliminate delays and losses.

PERFECT CORE BAKING ends manpower and casting losses due to make-overs and rejects.

PERFECT MOLD DRYING for true-to-pattern castings and easy cleaning.

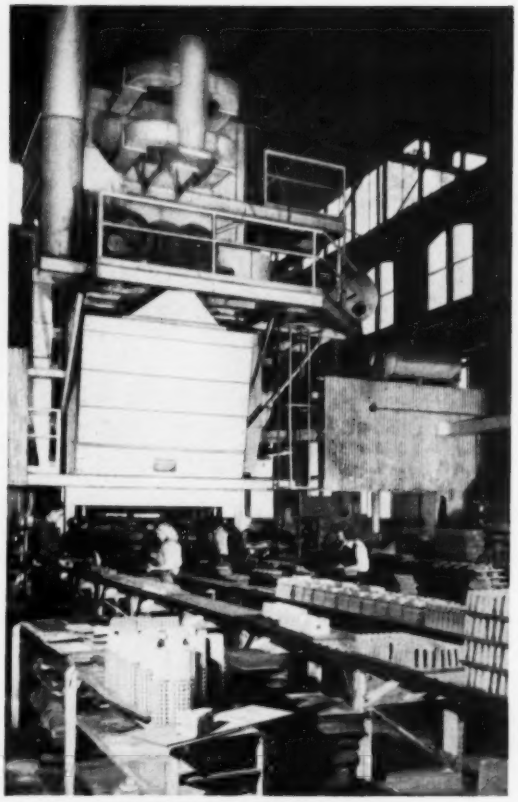
INCREASED PRODUCTION by making the most efficient use of skilled and unskilled labor.

HEAVY DUTY CONSTRUCTION for continuous dependable performance, economical operation, and minimum maintenance cost.

GREATEST SAVINGS IN FUEL by using the most economical fuel available.

SAVE BINDER. Proper core baking atmosphere and uniform temperature permit important savings in conventional binders.

USE HIGH SPEED CORE BINDERS. Coleman Ovens have uniform temperature and accurate control to handle temperature-sensitive resins and pre-baked oils.



COLEMAN TOWER® OVEN

Eastern Malleable Iron Company, Wilmington, Delaware.

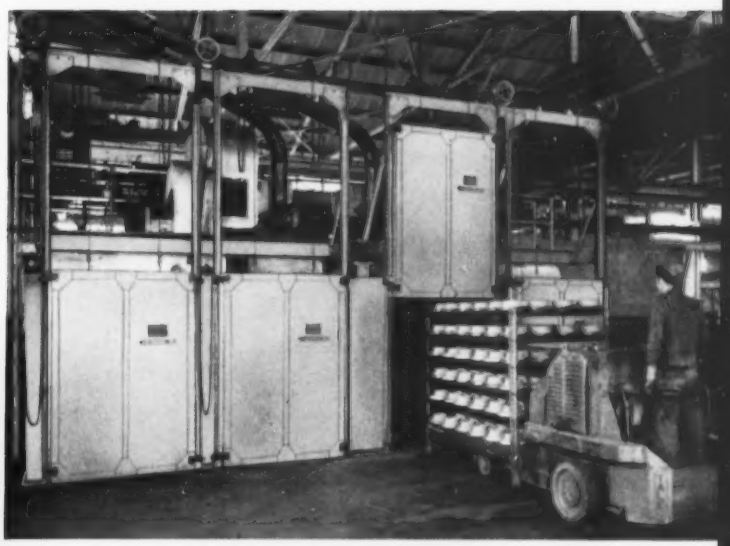
Write for Bulletin 48

A COMPLETE RANGE OF TYPES:

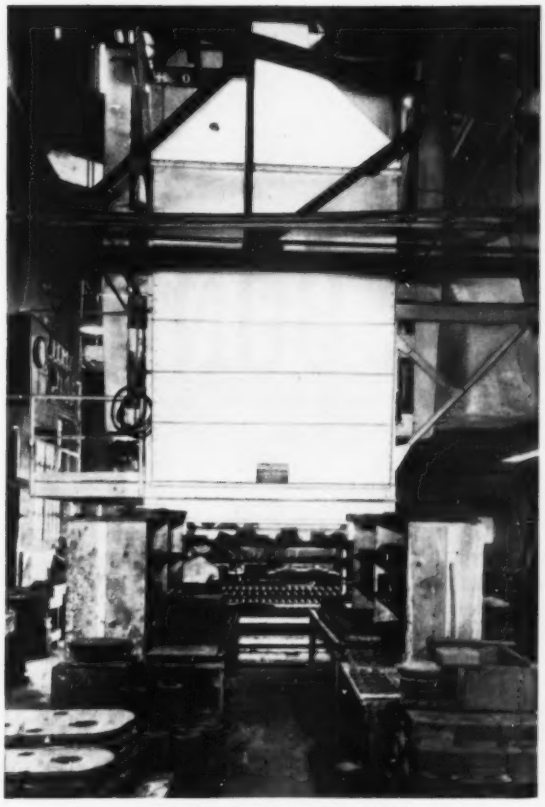
COLEMAN OVENS are built in a complete range of sizes and capacities for every core baking and mold drying requirement: Tower Ovens, Horizontal Conveyor Ovens, Car-Type Ovens, Transrack Ovens, Rolling Drawer Ovens, Portable Core Ovens, Portable Mold Dryers, etc.

from coast to coast

OVENS



COLEMAN TRANSRACK CORE OVENS
United States Pipe & Foundry Company, Decoto, California.



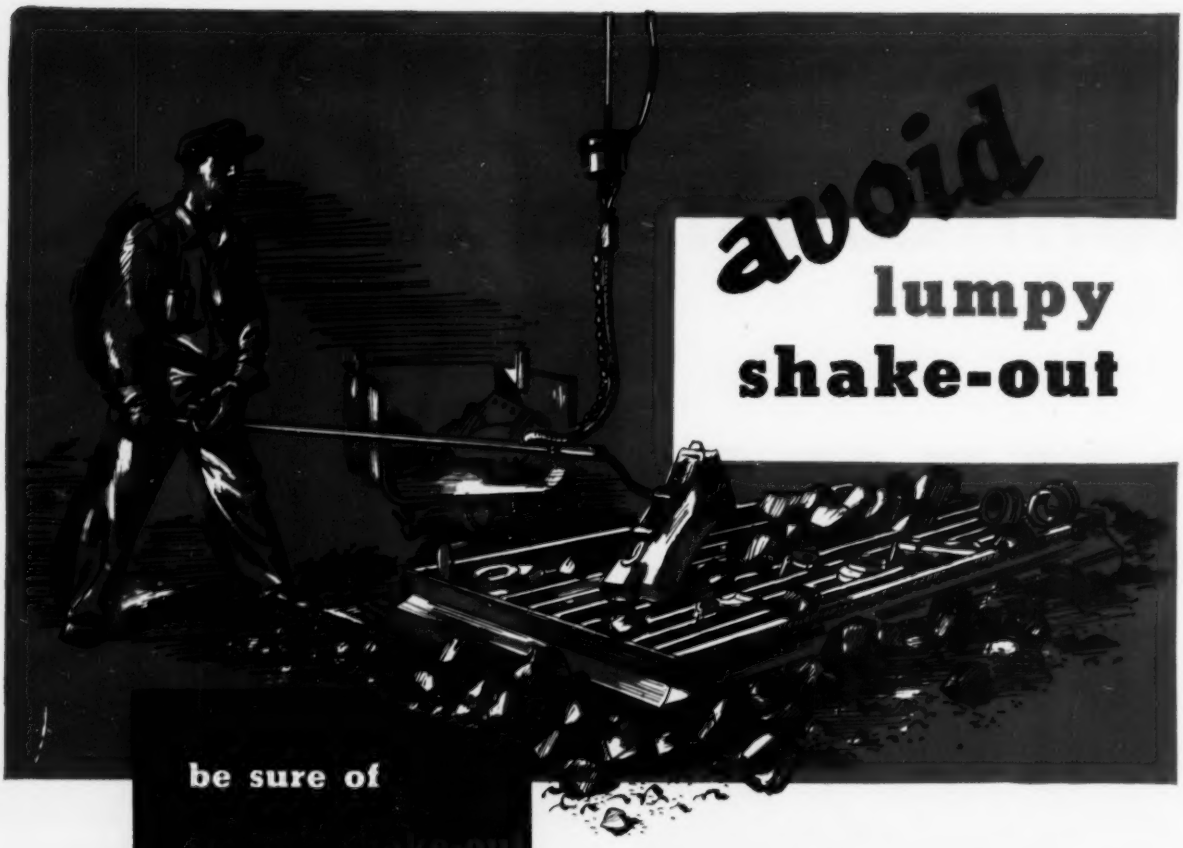
COLEMAN TOWER® OVEN
National Supply Company, Springfield, Ohio.

COLEMAN CAR-TYPE MOLD OVEN
The Bullard Company, Bridgeport, Connecticut.

THE FOUNDRY EQUIPMENT CO.

1831 COLUMBUS ROAD — CLEVELAND 13, OHIO

WORLD'S OLDEST AND LARGEST FOUNDRY OVEN SPECIALISTS



avoid lumpy shake-out

be sure of

and other big advantages with

DIXIE BOND

Why suffer from the waste and loss incurred in lumpy shake-outs? Avoid them! You can, with time-proven Dixie Bond. Dixie cuts your costs with quick, easy shake-out, less wear and tear on flasks, and fewer cracked castings, particularly in malleable or light or medium gray iron.

"How?" do you ask? *Because of Dixie's MODERATE dry and hot strength.* In green strength, however, Dixie surpasses every other bonding clay known to us as ever offered to American foundrymen. Besides, you benefit from high permeability, high flowability and high sintering point.

Even so, Dixie Bond may *not* be the very best for your specific job. In that case we will tell you so. With three other standardized clays, with specialized products and many combinations, we can and will advise you impartially.

For every ECP sale includes invaluable service *at no extra cost.*

* * *

Write for free factual literature.

E C P Since 1926

EASTERN CLAY PRODUCTS
DEPARTMENT
International Minerals & Chemical Corporation — 20 NORTH WACKER DRIVE, CHICAGO 6

QUALITY, SERVICE, DEPENDABILITY, PROGRESS

Minerals International Chemicals

DIXIE BOND • BLACK HILLS BENTONITE • REVIVO BOND • REVIVO CORE PASTE
BALANCED REVIVO • BONDACTOR • CUPOLINE • DURA PRODUCTS • WESTONITE

SAFEGUARD YOUR PERSONNEL and your PROPERTY!

Eliminate dangerous gases, fumes and dust with a MULTI-WASH collector

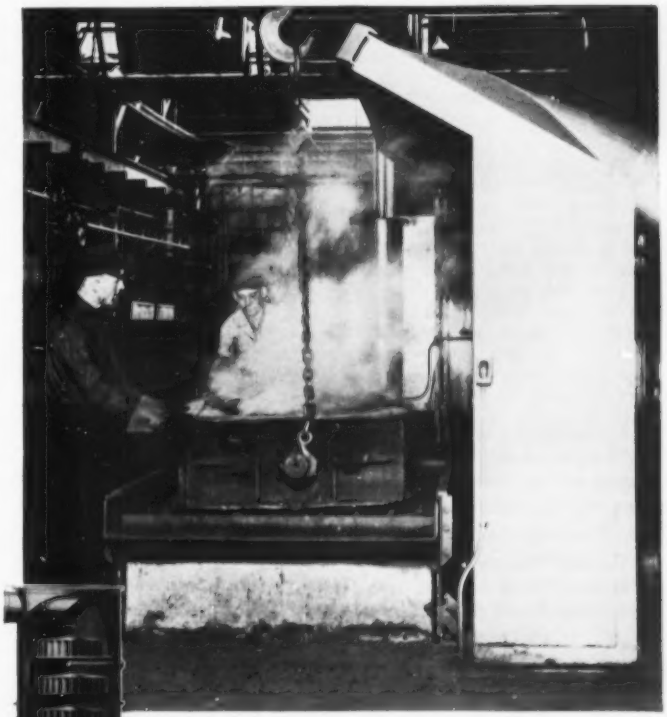
It will pay you to consider the many advantages of a Multi-Wash dust collecting system.

With Multi-Wash you won't have to dig yourself out of accumulated dust particles and furthermore you'll eliminate the danger of a spontaneous fire. Personnel too, will find conditions more agreeable and production will increase, because the cause of sick leave due to ailments attributable to dust and fumes will be substantially eliminated.

You can start in a small way to clean up objectionable dust and fumes by installing a Multi-Wash unit in the most offensive area first. Later, you can add on as conditions warrant.

From a dollars and cents approach you'll be far ahead with Multi-Wash both production-wise and maintenance-wise.

Be wise, contact your local Schneible representative or write direct for a further study of your dust and fume problem.



MULTI-WASH

MULTIPLIES WASHING FOR TOP EFFICIENCY

CLAUDE B. SCHNEIBLE CO.

P. O. Box 81, North End Station
Detroit 2, Michigan

PRODUCTS:

Multi-Wash Collectors • Uni-Flo Standard Hoods • Uni-Flo Compensating Hoods • Uni-Flo Fractionating Hoods • Water Curtain Cupola Collectors • Ductwork • Velocitrap • Dust Separators • Entrainment Separators • Settling and Dewatering Tanks • "Wear Proof" Centrifugal Slurry Pumps

SCHNEIBLE

These firms know that it pays to use

MALLEABRASIVE®*

(SHOT AND GRIT)

for better, faster, cheaper cleaning...

HARNISCHFEGER CORPORATION, MILWAUKEE, WISC. REPORTS: Cleaning time reduced approximately 40% . . . blasting costs cut just about in half. As to quality of cleaning, we do not hesitate to state that it is the best we have ever attained.

LEBANON STEEL FOUNDRY, LEBANON, PA., SAYS . . . a saving of 48.8% per operating hour. Per ton of castings, cost was $0.52 (before). Malleabrasive reduced cost to $0.28 per ton or 46.6%. We would not hesitate recommending Malleabrasive.

TEXTILE MACHINE WORKS, READING, PA., REPORTS: Malleabrasive is outstanding. Consumption is 100 lbs. per day . . . (former) consumption varied from 400 to 600 lbs. Maintenance was cut more than one-third . . . all wearing parts are in service better than three times as long.

THE above excerpts are from just a few of the many letters in our files. They tell *us* what we've been passing on to *you*—Malleabrasive cleans better and gives you the lowest overall cleaning costs you've ever had! The *original* premium abrasive, Malleabrasive has approximately 50% longer life than other premium abrasives—2 to 4 times the life of ordinary abrasives. It reduces down-time and makes machinery parts last longer . . . turns out perfectly cleaned castings every time and costs less per ton of castings cleaned!

And Pangborn can prove it, too! Pangborn will test Malleabrasive in your plant for 30 days, *at no cost to you*. Your machines will be expertly adjusted by Pangborn engineers to get the greatest benefit from Malleabrasive. Your work schedule will continue uninterrupted while this test is being run. After 30 days you'll see for yourself that our claims for Malleabrasive are true. Let Pangborn engineers run this impartial test in *your* shop! For additional information, write to: PANGBORN CORPORATION, 1300 Pangborn Boulevard, Hagerstown, Maryland.

Malleabrasive Guarantees Lower Cleaning Costs and Better Cleaning Jobs Than Any Other Abrasive!

Packed in orange striped 100-pound bags

Look to Pangborn for the latest developments in Blast Cleaning and Dust Control equipment

*U.S. Patent # 2184926 (other patents pending)

Pangborn

BLAST CLEANS CHEAPER

with the right equipment for every job

Foundry men in the news

Dan A. Mitchell has been promoted to vice-president of Progressive Brass Manufacturing Co., Tulsa, Okla., by the board of directors. Mr. Mitchell has been associated with Progressive Brass for 22 years, starting as a part-time worker while attending high school. He will assume management of sales, customer relations, and advertising. He has worked in every department of the firm and at one time had charge of all the analytical work in the laboratory, maintaining control of the many alloys used in the foundry. Later he became assistant foundry superintendent and departmental foreman.

John C. Pangborn, Jr., son of first vice-president John C. Pangborn, has been appointed Hagerstown District sales manager by Pangborn Corp., Hagerstown, Md. Mr. Pangborn's promotion follows years of experience in blast cleaning and dust control fields. Since returning from overseas duty he has served as an erector of Pangborn machines, as manager of the erecting and service division, as sales engineer in Detroit and for more than a year was the Boston representative. From 1951 until his recent promotion he was expediter and assistant head of the purchasing department.

Rogers Iron Works Co., Joplin, Mo., announces the retirement of **Charles B. Rogers** as president and his election as chairman of the board of directors. The change in Mr. Rogers' position comes after more than 50 years as an officer and president of the company which was founded by his father. He entered the company in 1902 after completing his schooling at the Missouri School of Mines and has served as president since 1926.

Thomas L. Harsell, Jr., head of the newly formed Harsell Engineering Co., has confined much of his professional career to the study of air pollution control. He was employed in 1949 by a group of 44 Los Angeles area gray iron foundries as consulting engineer to test types of remedial equipment for cupola installation. From knowledge gained in these tests he developed his present dust collecting system, which he will market nationally through his newly organized firm.

At the annual meeting of the Aluminum Association, January 20-22, **D. A. Rhoades,** Kaiser Aluminum & Chemical Corp., Oakland, Calif., was elected president. **A. V. Davis,** Aluminum Company of America, N. Y., was re-elected chairman of the board and **Donald M. White** was re-appointed secretary and treasurer.

Standard Horse Nail Corp., New Brighton, Pa., has made the following appointments: **R. S. Merrick,** vice-president, director of purchases; **W. C. Sheers,** manager, production and quality control; **H. K. Anderson,** supervisor, customer service; **Mrs. Alice Kifer,** assistant supervisor, order and invoicing.

C. F. Swigert, Jr., president of Electric Steel Foundry Co., Portland, Ore., since 1935, has been elected to ESCO's new top executive position, chairman of the board. **Newman Ward,** vice-president and general manager of the company succeeds Mr. Swigert as president. **Robert C. Warren,** vice-president and general manager of Cascade Manufacturing Co., was elected a member of the board of directors. ESCO's new branch office at Salt Lake City, is to be headed by **Garland Allen. Scott Kunkel** is new manager of sales for the Los Angeles district.

Henry Levitt, vice-president of Bohn Aluminum & Brass Corp., Detroit, and general manager of Michigan Smelting & Refining Div., Detroit, is celebrating his golden anniversary with the company. Mr. Levitt started with Michigan Smelting as bookkeeper, telephone operator, caretaker, and scrap sorter in 1903. In a short time he headed the firm which eventually became a Bohn subsidiary.

Norman A. Birch has been named general superintendent of foundries by National Bearing Div., American Brake Shoe Co., St. Louis. A graduate of MIT, Mr. Birch joined Brake Shoe in the metallurgical department in 1939, and served successively as process metallurgist and as division metallurgist. He is chairman of the A.F.S. Gating & Risering Committee.

Donald L. Boyes has been appointed production manager of the Central Foundry Div., General Motors Corp., Saginaw, Mich. **David T. Martin,** until recently executive sales engineer for that division, has succeeded Mr. Boyes as division sales manager.

Hyster Co., Portland, Ore., has appointed four new district managers. They are: **Robert Lange,** east-central district including the Washington office; **Art Morris,** north-central district including

J. C. Pangborn, Jr. . . district sales manager.

T. L. Harsell, Jr. . . forms engineering company.

N. A. Birch . . . named general superintendent.

E. F. Oyster . . . returns to SPO.

K. M. Smith . . . joins consulting firm.

G. O. Loach . . . assistant plant manager.

eastern Canada; **Walt St. Clair,** mid-central district; and **Robert Hile,** northwest district.

Prof. Clark B. Carpenter, head of the department of metallurgy at the Colorado School of Mines, has been appointed dean of the college's graduate school. Prof. Carpenter has served on the mines faculty since 1920, and will continue his duties as head of the metallurgy department while serving in his new position.

After 26 years of service at the National Bureau of Standards, **Harold E. Cleaves** has retired as chief of the chemical metallurgy section. He entered the chemistry division in 1912 and left the bureau in 1916, returning as a member of the staff of the metallurgy division in 1930. He was appointed chief of chemical metallurgy in 1946.

Gilfry Ward has been appointed president and **Joseph L. Mullin** first vice-president of American Manganese Steel Div., American Brake Shoe Co., New York. Mr. Ward joined the Amsco Div. as a trainee in the engineering department. Mr. Mullin joined the company as a clerk in 1914.

John F. Malsch was elected treasurer of E. F. Houghton & Co., Philadelphia, by the board of directors at a meeting following the annual stockholders meeting.

Earl F. Oyster has rejoined SPO Inc., Cleveland, as staff engineer. He helped form the organization in 1935 (he's the O in SPO). Mr. Oyster began his career in the foundry industry over 40 years ago as a molding machine designer. He has been in charge of the engineering staffs for several leading foundry equipment manufacturers.

Stafford W. Chappel, Jr., foundry superintendent of the Electric Boat Div., General Dynamics Corp., Groton, Conn., has been elected president of the Connecticut Non-Ferrous Foundrymen's Association. Before coming to Electric Boat, Mr. Chappell was foundry superintendent at Fay & Scott, Dexter, Me.

Kenneth MacKay Smith, foundry consultant, has joined the staff of Carl E. Rowe & Co., consulting engineers, Milwaukee, as foundry survey engineer. Mr. Smith recently served as foundry consultant for the Mutual Security Agency technical assistance program in Italy and has done free lance consulting work for American companies. He was formerly associated with Hansell-Elcock Co., Chicago, as assistant to the president; with W. O. Larson Foundry Co., Grafton, Ohio, as general foundry superintendent; with Turner & Seymour Manufacturing Co., Torrington, Conn., as assistant foundry superintendent; and with Builders Iron Foundry, Providence, R.I., as foreman in the non-ferrous shop.

The following appointments at Hydro-Blast Corp., Chicago, are announced: **Herbert J. Nieman,** vice-president of sales; **P. C. Will,** vice-president of engineering; **W. F. Gamble,** secretary-treasurer; **John W. Watson,** chief production engineer.

J. A. Havnen became foundry manager of Wilkening Mfg. Co., Philadelphia, the first of the year. He was formerly foundry superintendent of Liquid Carbonic Corp., Chicago, and assistant foundry superintendent of Wells Mfg. Co., Skokie, Ill.

F. Peter Drake has been appointed manager of operations of Continental Foundry & Machine Co., East Chicago, Ind. Mr. Drake, who has been operating an industrial sales agency in Los Angeles, will be in charge of Continental's works in East Chicago, Coraopolis, Pa., and Wheeling and Warwood, W. Va.

Samuel Sloan Auchincloss has been elected president of DeWalt Inc., Lancaster, Pa., subsidiary of American Machine & Foundry Co. He has been executive vice-president of DeWalt since August 1952, and succeeds Paul Gardner who resigned December 1952.

At the annual board of directors meeting of American Cast Iron Pipe Co., Birmingham, Ala., the following officers were elected: **C. O. Hodges,** president; **S. D. Moxley,** executive vice-president, purchases and engineering. **Lester Long,** vice-president, sales and secretary; **J. A. Woody,** vice-president, production; **A. E. Bowen,** treasurer; **F. H. Coupland,** works manager; and **F. B. Shannon,** assistant secretary.

Electro Metallurgical Co. of Canada Ltd., Toronto, has announced the appointment of **G. O. Loach** as assistant manager of its Welland Plant. Mr. Loach, who has been with the company since 1945, was elected a director and vice-president in 1951. He was previously engaged in sales and technical service activities. In addition to these duties he will now be concerned with production and operations in general.

Kenneth C. Vincent has been appointed supervisor of extraction metallurgy at Armour Research Foundation, Illinois Institute of Technology. Before joining the Foundation, Dr. Vincent was chief metallurgist for the Baroid Sales Div. of National Lead Co., Houston, Tex.

Chain Belt Co., Milwaukee, has appointed **Bernhard G. Schneider** to the newly created post of assistant chief engineer of the Conveyor & Process Equipment Div. The company has also appointed three new company officers. **Luther H. Bosnian** will be vice-president of manufacturing facilities, **Lyman Newton** will succeed the late **A. F. Kessler** as controller, and **F. D. Tincknell** becomes assistant treasurer.

W. M. Shafer, in charge of metallurgical and chemical research at National Radiator Co., Johnstown, Pa., has been made manager, metals research. Dr. Shafer, who came to National in 1946 as a metallurgist and chemist, is a graduate of the University of Illinois. Before joining National he was instructor in chemistry at Texas College of Mines, and later research metallurgist and chemist with Fansteel Metallurgical Corp., Chicago.

Edward J. Scott has joined the sales staff of U. S. Graphite Co., Saginaw, Mich., as their Texas representative. His

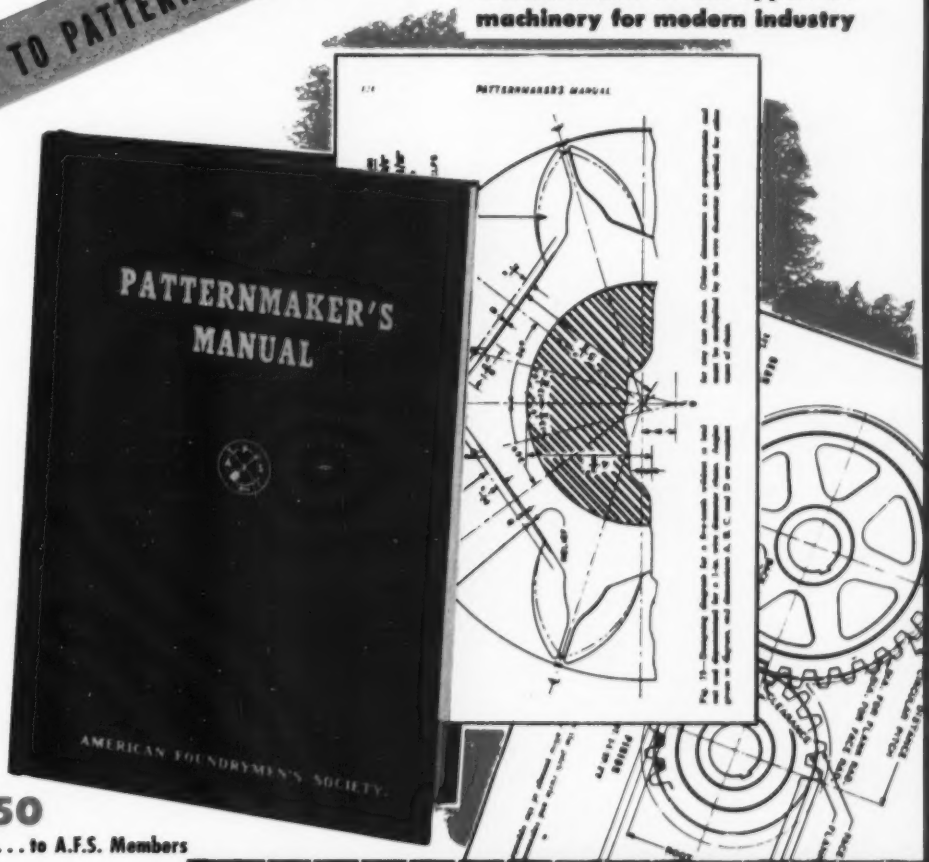
continued on page 110

Quick...

Reference and Application

TO PATTERN SHOP PRACTICE

Patternmaking, today, is an all important factor in efficient manufacture of all types of machinery for modern industry



A patternmaker must be readily able to read a drawing, sketch or blueprint correctly, and then visualize the finished product. He must have a comprehensive knowledge of foundry methods and techniques in order to efficiently construct the pattern to required specifications.

It was to meet the demands of the foundry industry for sufficient and authentic material for in-service training of the apprentice, as well as a source of quick reference for the trained mechanic, that the new **PATTERNMAKER MANUAL** was completed under direction of the A.F.S. Pattern Division.

Typical pattern problems are included in this First Edition of a 288-page, case-bound book that deals exclusively with basic principles that are generally applicable to the manufacture of most types of patterns.

4.50 ... to A.F.S. Members

6.75 ... to Non-Members

Rules, tables and technical data have been carefully assembled to make available the type of information that will be of vital help to all phases of patternmaking.

PATTERNMAKER'S MANUAL represents original contributions from men in every branch of the foundry industry ... from Master Patternmakers, in U. S. Naval Shipyards, as well as leaders in private enterprise — their thinking is combined in this new book, now available.

AMERICAN FOUNDRYMEN'S SOCIETY

616 South Michigan Avenue, Chicago 5, Illinois

Please send me promptly _____ copies of PATTERNMAKER'S MANUAL.

I enclose $_____ Cash ☐ Money Order ☐ Check ☐ to cover.

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ P. O. ZONE _____ STATE _____

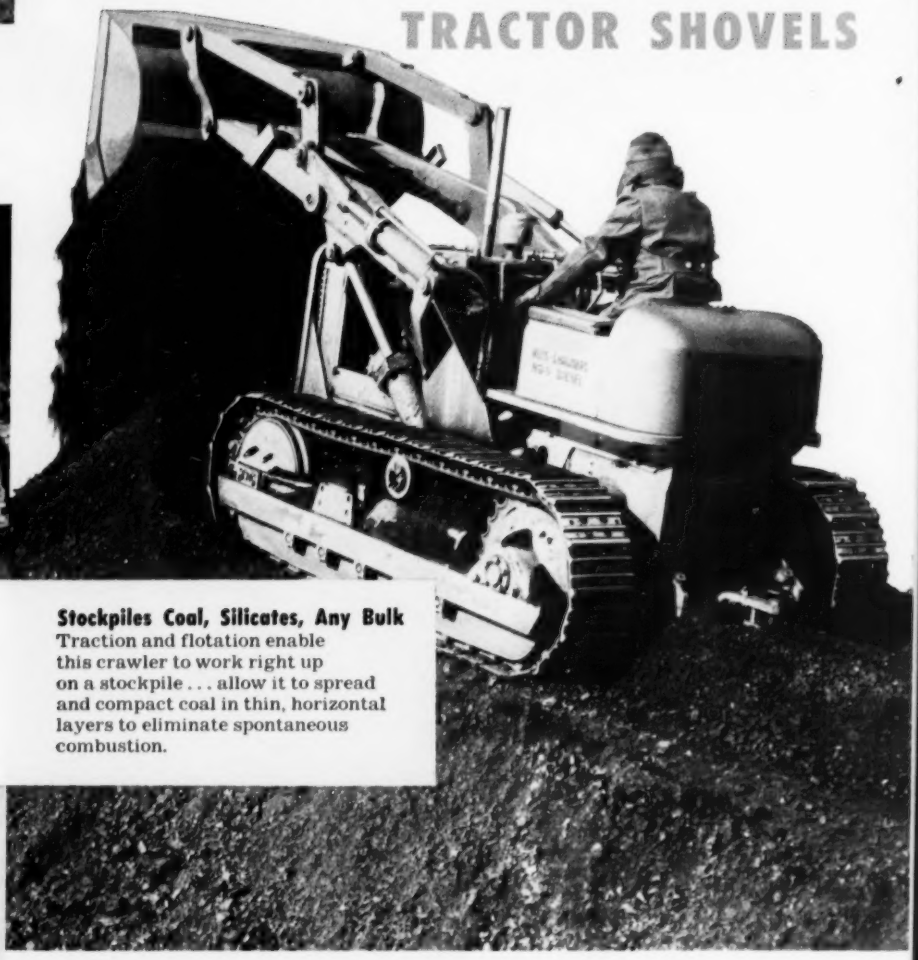
Postage paid by A.F.S. when remittance accompanies order

New Trends in Mechanized Materials Handling

WITH ALLIS-CHALMERS TRACTOR SHOVELS

Feeds Hoppers, Conveyers
Special high-speed reverse increases output on short runs between stockpile and hopper. Steel tracks stand up in cullet and other sharp, abrasive material.

Excavates, Loads Trucks
This busy crawler-mounted shovel has the power to dig into hard-packed materials — and bring it out, a full cubic yard at a scoop. In handling light materials, an interchangeable two-yard bucket doubles its capacity.



Stockpiles Coal, Silicates, Any Bulk
Traction and flotation enable this crawler to work right up on a stockpile . . . allow it to spread and compact coal in thin, horizontal layers to eliminate spontaneous combustion.

Handles Packaged and Solid Materials
With Lift Fork in place of bucket, the HD-5G skids, carries and stacks palletized loads weighing up to 4,000 lb. Stacking height beneath forks is 106 inches.

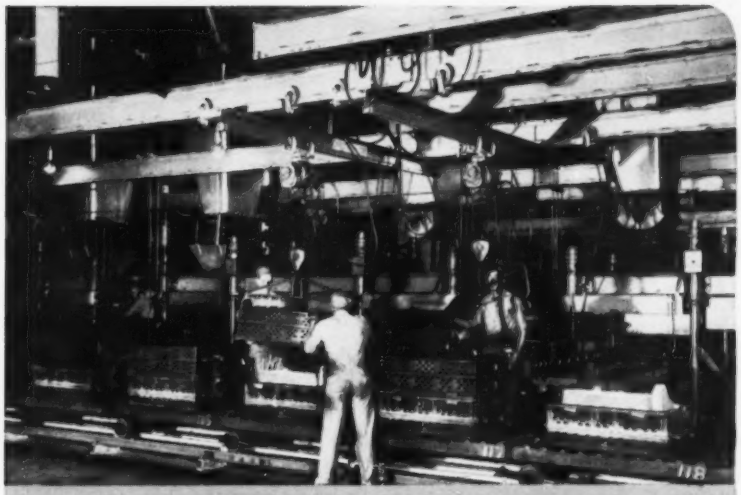
Crawler tractors — basic machines on earth-moving and construction jobs — are now solving more and more bulk materials-handling problems in industry with hydraulic front-end shovels. And spear-heading this new trend is the Allis-Chalmers HD-5G — thousands of which are now in use in plants of all types. This multi-purpose crawler combines power, traction and maneuverability with a wide selection of hydraulically operated attachments for a variety of material handling jobs.

Get the full story on how crawler tractor power and versatility can help mechanize your tough jobs. Ask your Allis-Chalmers dealer about the HD-5G and these three larger tractors shovels: 2-yd. HD-9G, 3-yd. HD-15G and 4-yd. HD-20G. Light materials buckets range from 2 to 7 cu. yd.

ALLIS-CHALMERS
TRACTOR DIVISION — MILWAUKEE 1, U. S. A.

Here are a few of the other jobs the HD-5G and its attachments will handle:

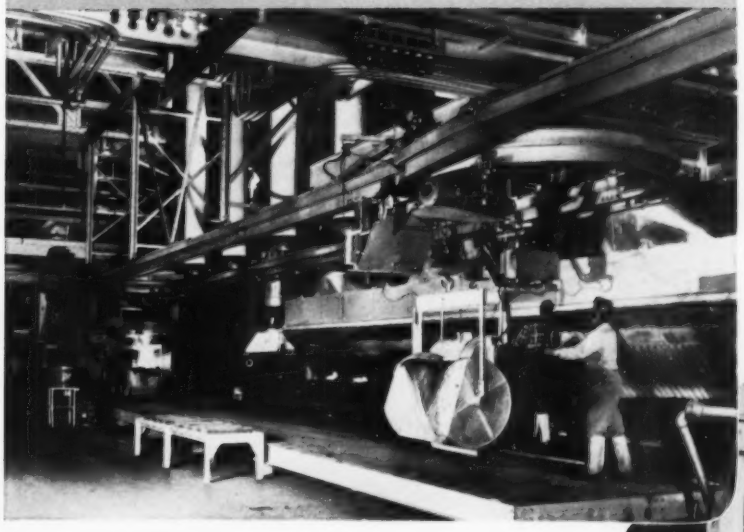
Maintains yards and roads with bulldozer or shovel • Clears snow from parking areas • Moves machinery and other heavy materials with Crane Hook attachment • Spots railroad cars at loading docks • Digs trenches for pipe or foundation footings with Trench Hoe attachment



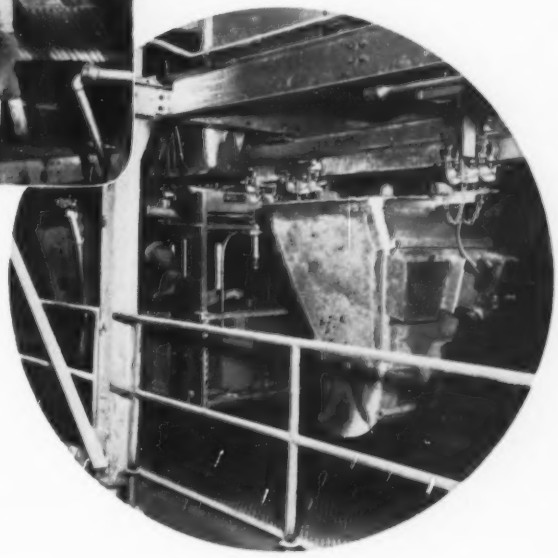
American MonoRail Cranes handle flasks through core setting to closing of cope and drag. 140 of these 1-ton cranes operate on 5800 feet of American MonoRail Girder Rail on the flask preparation line.

AMERICAN MONORAIL

Moves Core Sand, Flasks, Ladles in the NEW FORD FOUNDRY



At the pouring loops, ladles on American MonoRail carriers move at the same rate as the flasks for quick, easy pouring. 41 carriers operate on 1250 feet of Shielded Rail Master Track to complete this operation.



American MonoRail equipment in the new Ford Cleveland Foundry moves core sand from hoppers to core blowers by means of 3 cab operated carriers on a Shielded Rail Master MonoRail System which includes 950 feet of track and 10 motor operated 2-way glide switches.

Other systems, as illustrated, handle flasks and ladles over extensive American MonoRail Installations.

Experienced engineers will be glad to consult with you on any handling problems in your foundry. Write for the new "Case Study File" showing other applications.

THE AMERICAN MONORAIL COMPANY

13122 ATHENS AVENUE **CLEVELAND 7, OHIO**

RARE EARTH METALS

To Assist You In Solving Metallurgical Problems

CERIUM STANDARD ALLOY— #1

Analyzing:

50-55% Cerium
22-25% Lanthanum
15-17% Neodymium
8-10% Praseodymium, Terbium, Yttrium, Illinium, Samarium

0.5 to 1.5% Max. Iron

CERIUM STANDARD ALLOY— #2

Analyzing:

30-38% Cerium
32-35% Lanthanum
22-25% Neodymium
7-9% Praseodymium
0.5 to 1.5% Max. Iron

MISCHMETAL-MAGNESIUM ALLOYS

90% Mischmetal — 10% Magnesium
80% Mischmetal — 20% Magnesium
70% Mischmetal — 30% Magnesium
60% Mischmetal — 40% Magnesium

Mischmetal and its alloys have produced excellent results in the following applications:

STAINLESS STEEL:	Certain grades have shown marked improvement in hot workability.
HIGH TEMPERATURE ALLOYS:	Improves resistance to oxidation at elevated temperatures.
STEEL CASTINGS:	Improves castability, ductility and low temperature impact values.
DUCTILE IRON:	Counteracts effect of subversive elements such as titanium, lead, aluminum, etc. Consistently results in improved physicals.
MAGNESIUM AND ALUMINUM CASTINGS:	Alloys of magnesium and aluminum show marked improvement in creep resistance at elevated temperature.

Write us for further information and literature on any of the above applications or for your specific problems. Your inquiry will receive prompt attention.

PHILO · TACOMA · BRILLIANT

Ohio Ferro-Alloys Corporation
Canton, Ohio

Chicago Detroit Pittsburgh Tacoma Seattle
Minneapolis Birmingham San Francisco Los Angeles

Ohio Ferro Products

- FERRO - SILICON 25 - 50 - 65 - 75 - 85 - 90%
- SPECIAL BLOCKING 50% FERRO - SILICON
- SILICON METAL
- HIGH CARBON FERRO-CHROME
- LOW CARBON FERRO-CHROME SILICON
- FERRO - MANGANESE
- BOROSIL
- SIMANAL
- RARE EARTH ALLOYS

Briquets

- SILICON
- MANGANESE
- SILICO-MANGANESE
- CHROME

The dollar has two sides . . .

■ There is one great benefit to be derived from interest in any new process. Its consideration means *comparison*—with present practice.

Many factors are involved in the study of any new process, beyond the mere fact that it may be "new": Capital investment, installation cost, physical plant changes, period of amortization, integration with other processes, availability and training of working force, interim production interruptions, control requirements and facilities, quality control, and—final proof of the economic pudding—acceptability of estimated selling price.

Few companies can indulge a passion for progress by waiving the most careful of comparisons with present practice, costs and competitive position. And only when such comparisons involve *like to like and equal to equal*, can the economics of the new vs. the old be evaluated. Thus, inevitably, foundry progress may be advanced as much by making the most of what we have as by broad adoption of a new process.

A case in point is the article in this issue (p. 36) on *"Getting the Most from Naturally Bonded Sands."* In urging maximum use of the tried and true before venturing into new and unknown processes, the author is undeniably sound but almost certain to be misunderstood.

Every foundryman knows, all too well, how quick the public is to accept the new simply because it is new. The casting of metals is an ancient art of man, yet the average man on the street has little conception of the ingenuity and proficiency that goes into making a casting.

The interest in the new *per se*, against the well known and familiar, has long been traditional in our schools and colleges, and still constitutes the major interest of faculties and students. Only in recent years, due largely to the Foundry Educational Foundation, have some colleges recognized the inherent engineering usefulness of metal casting and made foundry training prescribed subjects. Emphasis on the new still follows most graduates into contact with the foundry industry, where they quickly conclude that nothing "the Old Man" does is any good, so "let's change it."

Few processes have so caught the imagination of foundrymen as has shell molding. At the industry's annual conventions, before the A.F.S. chapters, in this magazine and others, and in scores of foundry plants, shell molding is the "hottest" subject today. Hundreds of good foundry brains are examining the claims and counter-claims, experimenting, weighing results against cost, and (besides cussing) reaching certain conclusions still unpublicized.

The foundry progress of the past 30 years . . . truly a "Golden Age" for the application of engineering and science to foundry work . . . cannot be allowed to diminish. Every new and promising material, process and product should be examined for what it can contribute to the arts and sciences of metal casting . . . but on the basis of economic comparison between the new and the old . . . and *both as they were intended to be employed.*

If, without in any way curtailing the accent on science and engineering in the casting of metals, we now would devote equal thought and ingenuity to betterment of our present practices as well, who can say what new "Golden Age" will be attained? The information is already available; it has been published continuously for over 50 years. With our eyes on the present and our ears for what's ahead, we can still keep in mind that the fellow who coined the phrase about "the forest and the trees" knew what he was talking about.

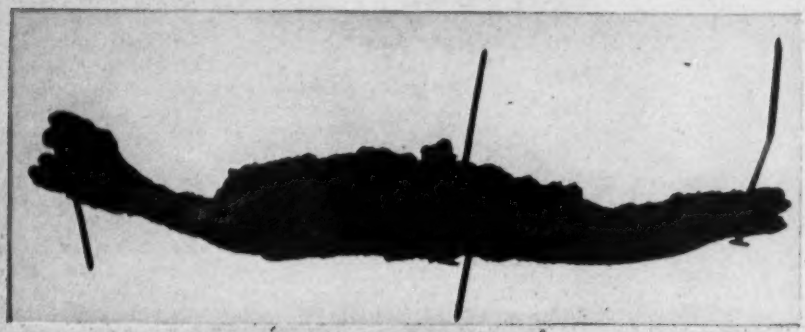
Wm. W. Maloney

Secretary A.F.S.

WANTED

APPREHENSION AND ARREST OF THESE UNDESIRABLES

Usually seen in foundries where supervision has been given too little time and help to eliminate them.

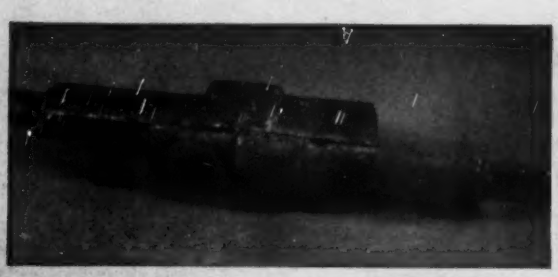


From a large dry sand mold which was vented to the cinder bed with manila hemp rope. Gases didn't go down the vent, but the metal did. (You can still see outline of rope.) Why didn't the cope blow off? Just a lucky break, that's all!

A scab and a blow in the same casting. Hard ramming was the culprit in this case. Sounds logical, but some say they've been unable to make a blow and a scab in the same area by ramming hard. Can you?

It's hard to do things this wrong, but if you really *wanted* to make blows like these, how would you do it? One way is by high moisture and hard (guess how hard!) hand ramming. What price control?

Our old friend Mr. Shift. Remedy: better equipment, less carelessness, a little more supervision. Lacking these anything can happen — and usually does!



Molder reversed cope because flask had two identical pins and guides (from where the supervisor stood, it *looked* all right!) Even sand control won't stop this.

How foundrymen can get the most

From naturally bonded sands

CLYDE A. SANDERS / *Vice-President, American Colloid Co., Chicago*

Advantages and disadvantages of natural molding sands and how to use them properly are described in this paper based on the author's presentation before the New England Regional Foundry Conference.

■ Although ancient man was given credit for making the first molds in a hollowed-out stone, it wasn't long before naturally bonded sands were generally accepted as the most versatile molding material available to the casting industry. Nature has been kind and has done a splendid job in furnishing excellent deposits of naturally bonded sands scattered widely throughout the world. Many prominent industries have located near good supplies of molding materials in order to obtain best efficiency in production.

Yesterday's craftsmen produced castings, particularly statuary, that have yet to be improved upon with equal skill and artistry by modern methods. Most of these metal treasures were cast in naturally bonded sand molds.

For many years the foundry industry has been trying to replace not only its existing operating methods, but also certain of its raw materials, with improved practices and materials. This is a healthy condition, representing progress in a basic industry. However, a sound approach must be taken when these changes are contemplated, and decisions must be based upon facts instead of unsupported opinions.

The new always attracts

A number of years ago, the term *synthetic sand* suddenly became prominent in technical talks and literature. Many of these early discussions stated that foundries were obsolete, behind the times, ignorant of progress, etc., if they continued to use naturally bonded sands.

Other parallel cases have developed in more recent years. Only a short time ago many small gray iron foundries with inadequate operating control thought they could make nodular iron with their available equipment and offer a product competitive in physical properties with higher priced castings. Nodular iron, of course, has its rightful place in the foundry industry, but for some small foundries it has not proved to be exactly the "end of the rainbow" once envisioned.

Today considerable attention is being given to shell molding. The foundryman who was told how chemically bonded sands would cure his worries, now is hearing that another process will cure all ails. It is easy to understand that the claims of shell molding should appeal to management. However, if management were to spend more money, time and effort in supplying its present foundry with better equipment, flasks, patterns, and supervision, we believe these "miracle" processes and materials would offer less appeal.

Every process has a place

Unquestionably, there is a definite place in the foundry industry for any sound process. There is a place for shell molding, just as there is for green sand molding, dry sand molding, loam molding, investment molding, skin-dry molding, die casting, permanent mold casting, the lost wax process, core molding, cement sand molding, chamotte molding, etc.

Close to quitting time, heat a little delayed—so the day crew shook out too soon. That explains how the castings bled. Where was everybody?

Here's what can happen when the molder shows up the "morning after" a bit weary and weak. Soft ramming caused this swell.

Someone told the man to knock off the risers on a newly poured floor. Nobody said "when," so this is what happened.

But each must stand on its own merits and find applications based on demonstrated advantages rather than on mere opinions.

The use of naturally bonded sands offers four principal advantages to foundrymen:

1. Naturally bonded sands are preferable where sand handling equipment, particularly for mulling, is limited.
2. Naturally bonded sand maintains moisture content for a relatively long length of time.
3. A wider working moisture range is obtained with naturally bonded sands than with other types.
4. Molds are more easily patched and finished when a proportion of naturally bonded sand is present.

Control all-important

Control and supervision are important in all molding operations. This applies to raw materials as well as to practice. To make naturally bonded sands superior in character, just as much control should be given to them as to other practices, although they seem to be taken for granted all too frequently.

Most naturally bonded sands usually have low durability and become weak after being used several times. They must be continually built up in strength without the sacrifice of important mechanical properties. Additions of new naturally bonded sand, or a bonding agent such as fireclay or bentonite, is recommended for this purpose.

Actually, no true naturally bonded molding sand exists after cores have collapsed into the molding sand. Complete sand, grain and clay characteristics have been changed. It is just as wrong to say one is using naturally bonded sands where a preponderance of cores are used as it is for one to say that a synthetic mixture is being used. The word *synthetic* is incorrect and should be replaced by *blended mixture, compound mixture* or something else other than the word *synthetic*. However, since it is commonly used and has been accepted as a foundry phrase, it will be retained in this article.

New sand additions needed

As already stated, naturally bonded sands have low durability and become weaker after use. Weak sands promote cuts, washes, drops, swells, sand inclusions and other defects, but weakness can be avoided if new molding sand or bonding additions are added to the system daily, at the muller, on the top of each mold, at the shakeout, or over the floor.

Burned clay from any source is detrimental to molding sand. Renewing heap sands with more live clay refreshes the working characteristics and cuts down the build-up of fines in the system. Some very fine naturally bonded sands such as the Albany deposits, New Jersey deposits and New England sands help to hold moisture content and improve workability.

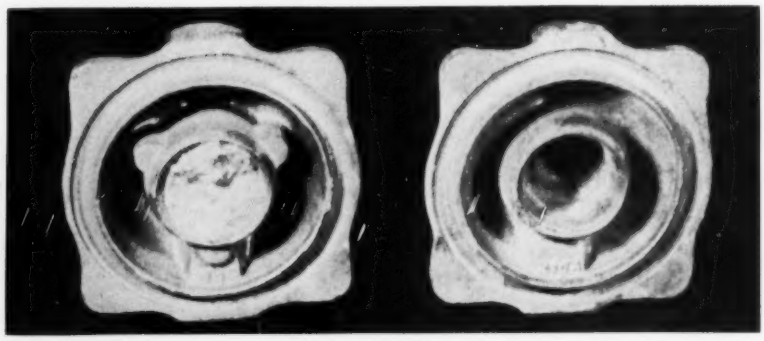
It is recommended that whether naturally bonded sands or synthetic sands are used, molding sands should be mulled and aerated. If a foundry is not equipped with mixers, naturally bonded sands are definitely the foundryman's first choice. Many foundries waste the cost of a muller each year by throwing away valuable sands that could be reclaimed by proper conditioning. Sands take on new life when mulled and obtain body which is urgently needed during ramming and lifting.

A thorough study of sand grain distribution also is most important to any sand system. Grain distribution should be determined by the dry method as well as by the wet. It is possible for sand to group or form agglomerates for many reasons and this condition should be checked regularly by screen analysis. After screening by the dry method, the A.F.S. clay content should be determined by wet screening. It is recommended that the test tube method (see facing page) be used.

Naturally bonded sand usually balls-up after the addition of too much water and too much riddling. Even attempting to screen out clay balls may aggravate the condition. Any fines, such as inert clay, may aggravate the situation if excessive amounts are present. Fine naturally bonded sand, alone and without bond additions, may ball up if not properly handled. One of the strong disadvantages of fine-grained naturally bonded sand in a mechanized unit is the constant danger of clay balls, which can be avoided by observing the following rules:

Rules for avoiding clay balls

1. Work the sand as dry as conditions permit.
2. Keep the clay content as low as possible.
3. Avoid excessive inert fines that easily build up in the system.
4. Control the ash content in the molding sand if material such as seacoal is employed.



Metal costs a lot more than sand. Here's a good (right) and bad cope lift. The molder could see it was bad but didn't block off the bad lift on a four-on pattern.

5. Reduce riddling to a minimum.

6. Avoid excessive handling of the sand, except for proper mulling.

7. Avoid heavy additions of new naturally bonded sands; try to add a minimum amount of bond with proper mulling, and add the least amount of new sand necessary to maintain the system.

8. Avoid long mulling and unnecessary movement of fine sand.

9. Use a facing material against the pattern to eliminate defects resulting from clay balls in the system.

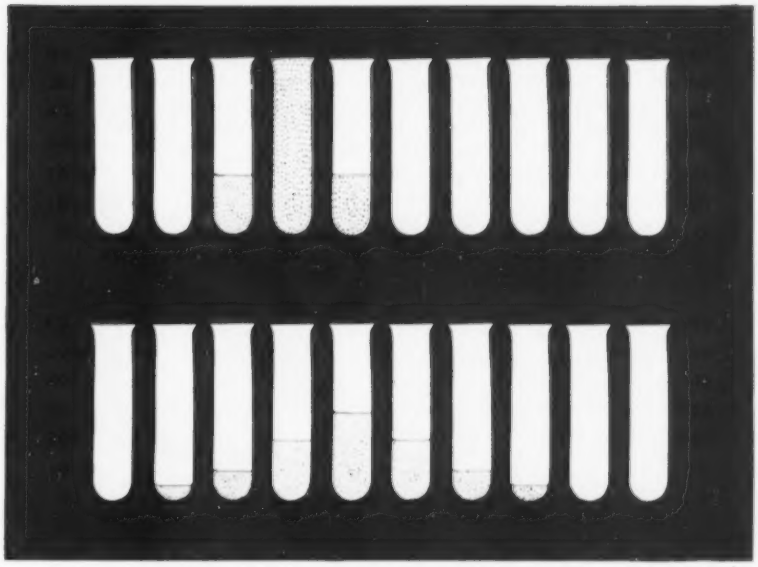
Moisture can be costly

Casting defects in foundries where naturally bonded sands are employed occur chiefly because of excess moisture content and low strength. Although moisture is the cheapest item in the foundry, it can become the most expensive. Moisture content usually gives a false plasticity much like the bonding of sand at the ocean beach. When the sun dries out the sand, the form collapses and does not hold shape.

A definite limit should be set for the moisture content, and rigid control should be exercised. A molder should obtain the feel of sand from the green compression strength and deformation, but strength should result from the presence of clay content rather than the "water feel."

Permeability is an important physical property in the sand system and can be controlled indirectly by a careful study of sand grain distribution. Excessive fines tend to drop permeability rapidly, but even small changes in the fine or coarse screens greatly affect permeability. Permeability should always be associated with ramming, since green compression strength and density both vary greatly with the degree of ramming.

It is obvious that a soft rammed mold has a greater permeability than a hard rammed mold of the same mixture, hence mold hardness is an important factor in the study of the mechanical properties of naturally bonded sand molds. Density tells how the sand packs and fits together, and this information should be combined with that on the properties of mold or green hardness, green compression strength and permeability. These factors should be considered as a unit. (See "*Measuring the Properties of Sand and Molds by One-to-Ten Ramming*," AMERICAN FOUNDRYMAN, October 1952, pp. 48-50.)



Three-screen sand (above) with bulk retained on center screen has high expansion, requires much bonding clay, sea coal, wood flour or cereal. Sand with proper grain distribution (below) does not require excess amount of plastic material.

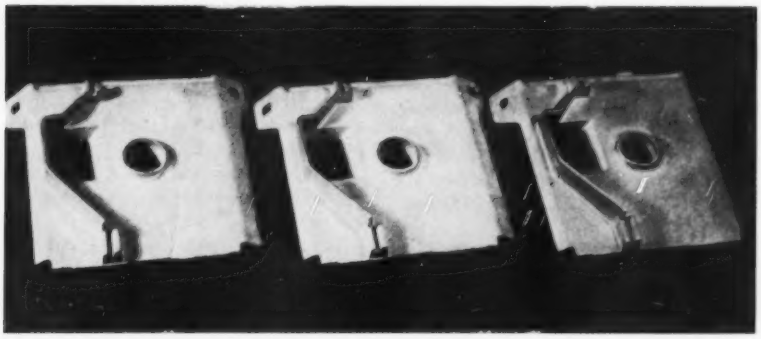
Causes of deformation

Not enough space is available to discuss deformation here, but it is a valuable tool in the making of good castings. Too much deformation is detrimental in certain foundries, and too little can cause an equal amount of damage. High deformation brought about by excessive moisture content, high clay content, high cereal content, or other circumstances may contribute greatly to "apparent shrinks."

A rubber-like sand mixture may deform or move on the mold-metal interface, thus causing an oversize and overweight casting which may cause bosses and heavy section to "cup-down," resulting in defects which resemble shrinks. Higher deformation insures better draws, for a very low deformation sand usually is so brittle that unless the pattern has considerable taper, the mold breaks easily. A sufficient amount of deformation should be sought, but nothing in excess of established specifications.

A careful study should be made of combustible materials, such as pitch, seacoal, gilsonite, wood flour and others. Although their use is not absolutely necessary, they furnish a reducing atmosphere which gives a better peel to the castings. It is incorrect to think that these ingredients alone will produce better casting finish, since casting finish should be governed mainly by the base sand selected. Cleaning costs are usually lowered when a reducing atmosphere is present.

Wood flour is added to overcome sand expansion principally, and it is claimed that there is less danger of



Just one day apart. At left and center rattails due to hard ramming and sand out of balance. More control produced the perfect casting at right.

such sand expansion defects as scabs, buckles, and rat-tails. On any flat plate, or flat pattern surface, such casting defects may occur when mold or green hardness is above 60. Small amounts of wood flour tend to overcome dense packing of the sand mixture, thus adding a certain amount of insurance against some casting defects.

Bentonite helpful

Bentonite bonds are widely used with naturally bonded sand. Western bentonite additions insure quick dry and fired strength, whereas southern bentonite furnishes better flowability to the molding sand mixture and facilitates shakeout. Improved flowability, of course, increases production.

When localities are without satisfactory naturally bonded sands and must import them, good control is vital to obtain the best economy with no advance in molding costs. If additional freight costs make these sands prohibitive in certain areas, substitutes must be selected.

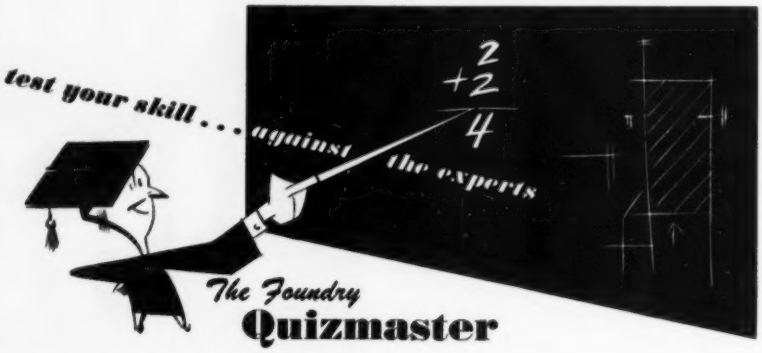
The ultimate goal is to produce a satisfactory casting at the least possible cost, and more attention is now being applied to studying good, flowable sands. With such sand, more molds per hour can be produced and labor costs reduced. A sand mixture with good flowability can carry a certain grain tightness because of sand grain interlocking so that less bonding material is required. A closer dimensional tolerance is always obtained with molding sand of good flowability, and that tolerance in turn reduces the amount of machining necessary and saves on the amount of metal required.

Easy shakeout desirable

Labor is reduced decidedly if molding sand passes through the perforated deck of the shakeout at a rapid rate, castings free themselves of adhering sand, and casting defects move briskly toward discharge. This operation requires control.

No matter which process is used or which type of raw material is selected, each sand, whether synthetic or naturally bonded, has a definite place in the foundry industry. The writer feels that ease of control, economy, proper sand grain distribution, cooler sands, flowability, longer working range of moisture content, workability, and other qualities required to produce a good casting can best be achieved with a semi-synthetic sand (part natural and part synthetic) and proper mold cavity atmosphere for such sand.

Foundrymen should study all available facts and base their decisions on casting results and costs. They should attempt to improve what they already have before seeking new methods; too many foundries have learned to regret quick decisions. Making a successful casting requires work, effort, control, know-how and elbow grease—not unfounded or unsupported claims.



Test your foundry knowledge with "The Foundry Quizmaster," a new feature of *American Foundryman* which will appear from time to time. Your reward for taking the quiz: Increased knowledge of foundry practice. The Quizmaster will deal with practical foundry subjects and cover the range of the cast metals. This month his subject is *Aluminum Casting Practice*. Answers will be found on page 96. If you don't agree with the Quizmaster, write a letter to the editor.

1. When dross inclusions are experienced, should the foundryman (1) stir the melt more thoroughly, (2) pour hotter, (3) reduce agitation?

2. Overheated metal (1700 F) should be (1) poured hot, (2) chilled by adding old gates, (3) allowed to cool naturally, (4) pigged and remelted.

3. A large aluminum casting will, in general, result in fewer casting problems when the number of gates used is (1) one, (2) two, (3) three, (4) four.

4. Bubbles located just under the casting skin are due to: (1) gas in metal, (2) too high pouring temperature, (3) mechanically trapped air, (4) insufficient risering.

5. The best holding furnaces for aluminum die casting machines are (1) gas, (2) oil, (3) coke, (4) electric induction.

6. Titanium added to a heat of metal at the plant will give as much grain refinement as if added in the customer's foundry. Yes___ No___.

7. The most effective degasser for aluminum is (1) dry nitrogen, (2) chlorine, (3) plunging fluxes.

8. Iron melting pots generally last much longer than non-metallic pots. Yes___ No___.

9. Pickup of an extra per cent from iron melting pots is very unlikely. Yes___ No___.

10. Best pouring technique requires: (1) the lip of pouring ladle close to the sprue, (2) hold lip high to get pressure.

11. If a casting must be poured at 1600 F to run, and it shrinks at the gate, it is advisable to: (1) use more gates, (2) pour two up, (3) vent the mold, (4) degas the metal, (5) choke the gate, (6) make the gate smaller, (7) place risers or shrink-bobs on the gates.

12. A casting temperature is correct (1) when it is as low as the casting can be run, (2) when the metal is cherry red, (3) when it is as low as can be used and still get a good casting.

13. Pin-hole porosity in castings can be blamed on the internal quality of the ingot. Yes___ No___.

14. It is possible to predict whether or not castings will shrink, from the degree of shrinkage visible in the ingot. Yes___ No___.

15. Overheating a melt of aluminum will burn it and impair its properties. Yes___ No___.

16. It is easier to make pressure-tight castings from an alloy low in silicon. Yes___ No___.

17. A low limit on which of the following elements is a requirement for the best corrosion resistance? Silicon. Magnesium. Nickel. Copper.

18. Anodizing is a form of (a) painting, (b) heat-treatment, (c) surface treatment, (d) sand-blast.

Near completion of program for

1953 CONVENTION

■ Names of those to be honored with Gold Medals and Honorary Life Memberships at the 1953 A.F.S. Convention in Chicago, May 4-8, have been announced by the Board of Directors and the Board of Awards. To receive these top industry awards at the Annual Banquet the evening of Wednesday, May 6, the men are:

DANIEL E. KRAUSE, executive director, Gray Iron Research Institute, Columbus, Ohio—the John H. Whiting Gold Medal *"for outstanding contributions to the Society and the Foundry Industry in the field of ferrous metallurgy and research."*

WM. J. GREDE, president, Grede Foundries, Inc., Milwaukee — the Wm. H. McFadden Gold Medal *"for outstanding public service bringing great credit upon and broad recognition for the Foundry Industry."*

WM. ROMANOFF, vice-president, H. Kramer & Co., Chicago—the Joseph S. Seaman Gold Medal *"for exceptional contributions to the Society and its Brass and Bronze Division for many years."*

JAMES H. SMITH, general manager, Central Foundry Div., General Motors Corp., Saginaw, Mich.—the Peter L. Simpson Gold Medal *"for outstanding contributions to the application of engineering principles in foundry practice, and as the 1953 Charles Edgar Hoyt Annual Lec-*[illegible]*."*

GEORGE J. BARKER, professor of metallurgical engineering, University of Wisconsin, Madison—Honorary Life Membership *"for outstanding contributions to the Society and the Castings Industry in the education of young engineers for greater appreciation of the industry, the casting process, and cast products as engineering materials."*

A.F.S. President I. R. Wagner, Electric Steel Castings Co., Indianapolis, Ind., who will preside at the Annual Banquet, will also receive Honorary Life Membership in the Society.

Banquet speaker will be George S. Benson, president of Harding College, Searcy, Ark. He is well known for his work in developing the school to express the fundamental principles of government upon which our country was founded, and carrying on a significant nation-wide program to enlist the aid of all Americans in rededicating the nation to these principles.

Full technical program

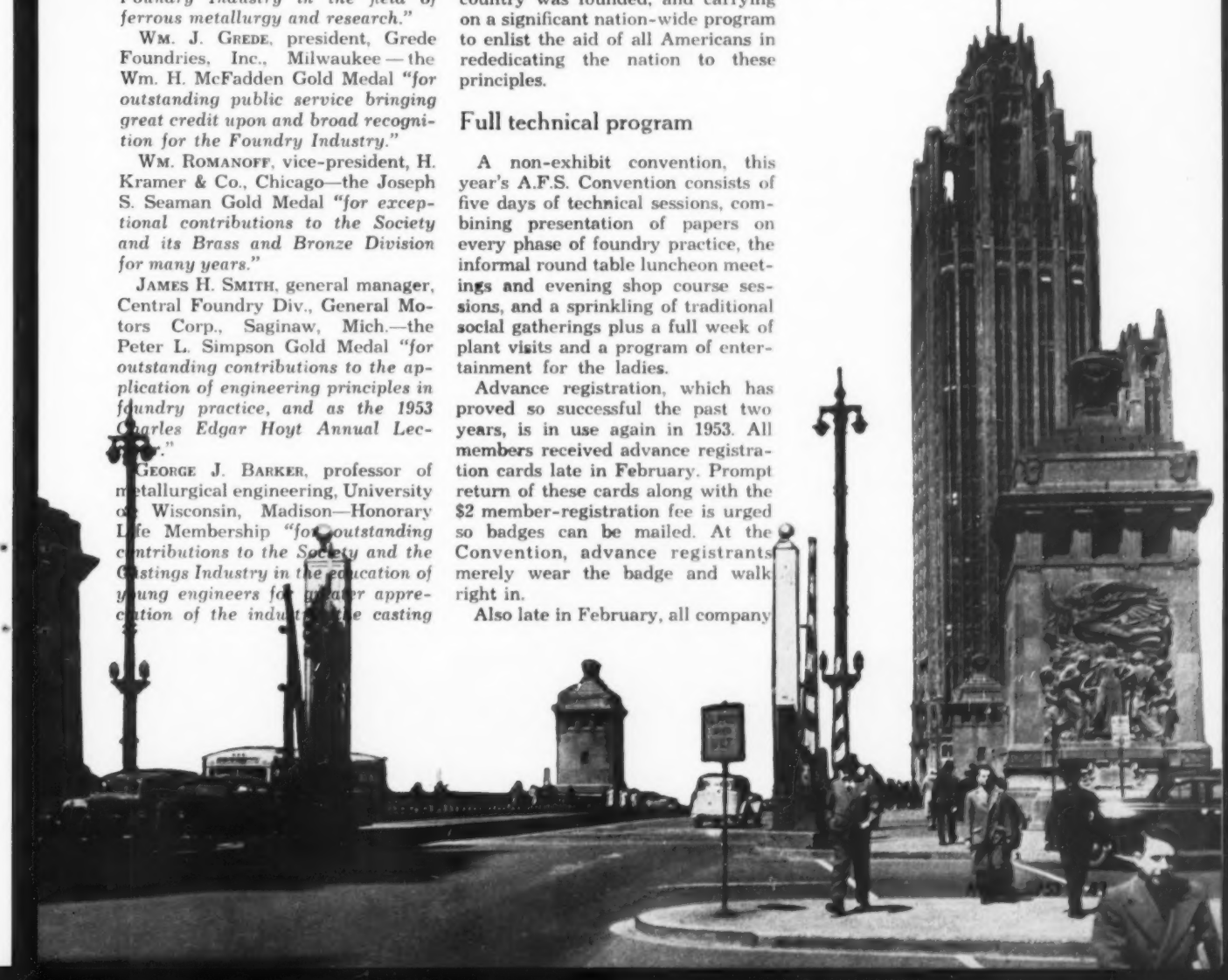
A non-exhibit convention, this year's A.F.S. Convention consists of five days of technical sessions, combining presentation of papers on every phase of foundry practice, the informal round table luncheon meetings and evening shop course sessions, and a sprinkling of traditional social gatherings plus a full week of plant visits and a program of entertainment for the ladies.

Advance registration, which has proved so successful the past two years, is in use again in 1953. All members received advance registration cards late in February. Prompt return of these cards along with the $2 member-registration fee is urged so badges can be mailed. At the Convention, advance registrants merely wear the badge and walk right in.

Also late in February, all company and sustaining members received forms enabling them to register in advance any employee, whether the individual is a member of A.F.S. or not, at the member fee of $2. Non-member registration fee is $5.

No registration is required for either members or non-members attending the evening shop course sessions.

Four Chicago Loop hotels—Bismarck, LaSalle, Morrison, and Sherman—have set aside more rooms for conventioneers than have been made



Traditional [illegible] business activities of the Convention are concentrated in the middle three days of the week to accommodate the greatest number of conventioneers. In addition to the Annual Banquet Wednesday evening, May 6, there is the Annual Business Meeting on the 7th. At the latter, National President I. R. Wagner will present his Presidential Address. Election of officers and directors, and presentation of Apprentice Contest Awards are also on the Annual Meeting program.

The Charles Edgar Hoyt Annual Lecture, to be delivered by J. H. [illegible] General Motors Corp., will follow the business meeting.

The Canadian Dinner is scheduled for the evening of Tuesday, May 5. Past presidents of A.F.S. will meet for their annual breakfast the morning of Wednesday, May 6, while past and present officers, directors, medalists, and honorary life members, who make up the Society's "Official Family," will attend the A.F.S. Alumni Dinner the evening of Thursday, May 7.

The ladies entertainment program, which will run throughout Convention Week, will start off with the A.F.S. Tea the afternoon of Monday, May 4, with the Society playing host.

Though this year's Convention will feature no commercial exhibits, two Society activities carried on for the foundry industry will be dramatized in displays. One of these, an annual feature now in its 30th year, is the [illegible] the past 11 years, there is no Housing Bureau. Housing applications were sent to all members the middle of January and room assignments are rapidly being made by the hotels.

[illegible] activities

[illegible] foundry [illegible] are expected to create [illegible] discussion and controversy [illegible] young and old foundrymen [illegible] compare what the apprentice has done with what their own experience dictates.

The 1953 A.F.S. Apprentice Contest has closed and entries not already in should be sent promptly to Prof. R. W. Schroeder, University of Illinois, Navy Pier Branch, Dept. of Mechanical Engineering, Room 72, Chicago 11, Ill. *Do not* send entries to A.F.S. Headquarters.

Patterns and castings should preferably be shipped rail express, and in any case *shipping costs should be prepaid.*

Also on display will be the more than 60 publications of A.F.S. These cover the field of foundry methods and operations and will include such recently released publications as the *Patternmaker's Manual, A Study of the Principles of Gating as Applied to Sprue-Base Design, Health Protection in Foundry Practice, Copper-Base Alloys Foundry Practice,* and *Symposium on Air Pollution.* In addition, *Statistical Quality Control for Foundries* and *Glossary of Foundry Terms,* expected to be available in April, will be on display.

Sand reclamation symposium

With primary emphasis on the technical program this year, the various divisions and general interest committees of A.F.S. have organized an impressive five-day program. Most of the sessions are the customary meeting featuring two technical papers. Two of the sessions scheduled for Wednesday, May 6, have been set aside for a Symposium on Sand Reclamation. Covered during these meetings will be all types [illegible] foundry sand [illegible] currently in operation [illegible] service data are available.

Sand Reclamation Symposium papers include: *"Development of Foundry Sand Reclamation," "Dry Reclamation of Steel Molding Sand," "Hydraulic Method of Wet Sand Reclamation," "Sand Reclamation in a Steel Foundry," "Control of Coating Characteristics Affecting Thermal Stability and Pneumatic Dry Scrubbing of Reclaimed Sand,"* and *"Sand Reclamation with the Combination System."*

Another symposium, sponsored by the Plant and Plant Equipment Committee, extends the popular meetings of last year into the field of coremaking equipment. Sessions are scheduled for the afternoon and evening of Thursday, May 7. The 1952 symposium on molding machines will be combined with this year's papers on coremaking in a publication expected to be available sometime after the 1953 Convention.

Plan round table luncheons

Seven of the sessions will be luncheon or dinner meetings, most of them featuring the informal give and take of ideas convention-goers associate with the round table luncheons. Luncheon discussion topics announced by the five metals divisions and the Pattern Division are: Gray Iron, Thursday, May 7—*"Scrap Reduction";* Pattern, Wednesday, May 6—*"Questions and Answers";* Light Metals, Monday, May 4—*"Shell Molding"* or *"Surface Finishes";* Brass & Bronze, Tuesday, May 5—will repeat popular discussion of prepared questions listed elsewhere in this article; Steel, Thursday, May 7—*"Hot Tearing";* and Malleable, Tuesday, May 5—to be announced.

The customary dinner sponsored by the Educational Division is set for the evening of Tuesday, May 5.

Eight shop course sessions are

planned. The only Convention sessions not requiring a badge for admission, they are scheduled for evening to accommodate operating men who may not be able to attend during the day. These sessions are free-for-all discussions with no prepared papers. All shop course sessions start at 8:00 p.m. The Gray Iron Shop Course will run the evenings of May 4, 5, and 7. Discussion topics scheduled are: *"Gating, Risering, and Pouring and Their Relation to Scrap," "Chill Control,"* and *"Carbon Control in the Cupola."*

The Sand Shop Course, also May 4, 5, and 7 will have for discussion: *"Pinholes in Castings," "Evaluation of Molding Processes—Green Sand, Permanent Mold, Die Casting, Shell Mold, Core Sand, and Dry Sand,"* and *"Mulling Techniques in Relation to Casting Quality."* Topics for the Brass & Bronze Shop Course, scheduled for May 4 and 5 are *"Furnace Practice"* and *"Evaluation of Molding Processes."*

Several papers on titanium melting and casting—first to be presented at an A.F.S. Convention—will be heard during sessions sponsored by the Light Metals Division. These include *"A Technique for Casting Titanium," "Mechanical Properties of Cast Titanium-Carbon Alloys,"* and *"Evaluation of Mold Material for Titanium Castings."*

More light metals papers

Among papers approved by the Light Metals Division are: *"Agar Gels in Plaster-Bonded Investments," "Practical Foundry Applications of the Principles of Ratio Gating," "Characteristics of High Strength Magnesium Casting Alloy ZK61," "Velocities and Volume Rates of Metal Flow in Gating Systems," "Magnesium Alloy Permanent Mold and Semi-Permanent Mold Castings,"* and *"Casting Magnesium Alloys in Shell Molds."*

Sand Division papers approved, in addition to those for the Symposium on Sand Reclamation, include: *"Induced Flow Process of Baking Cores," "Non-Ferrous Molding Sands," "Factors Involved in Making a Sand Mixture," "Casting Surface Finish and Flowability of Sand," "Resins and Sands for Shell Molding," "Flowability of Sand," "Deformation of Green Molding Sand," "Veining Tendencies of Cores," "Ramming of Molding Sands,"* and *"Shell Molding Materials Testing."*

Heat transfer to and from metal, the basis of foundry operations, will be considered in three papers sponsored by the Heat Transfer Committee. A review of the first eight years of A.F.S. heat transfer research and its practical meaning to the foundry industry will be presented, along with two papers entitled *"Solidification of Cylinders"* and *"Solidification at Corner and Core Positions."* The review—*"Foundrymen Can't Know Too Much About Heat Transfer"*—appears in two parts in the February and March issues of AMERICAN FOUNDRYMAN.

Three of the Steel Division papers are: *"Feeding Range of Joined Sections," "Influence of Molding Materials on the Incidence of Hot Tearing,"* and *"Performance of Cast and Rolled Steels in Relation to the Problem of Brittle Fracture."*

Papers approved by the Refractories Committee include: *"Advantages of Insulating an Electric Furnace Roof"* and *"Correlating Air Furnace Temperatures with Refractory and Operating Practice."*

Among papers in a heavy program sponsored by the Gray Iron Division are: *"Dephosphorization of Iron in the Basic Cupola," "Hardening Characteristics of Induction Heated Ductile Iron," "Risering of Gray Iron Castings,"* and *"Trends for the Relation of Chill Test Depth and Carbon Equivalent of Gray Cast Irons."*

"Graphitization in the Malleable Industry," "Influence of Melting Furnace Atmospheres on Casting Properties and Annealability of Malleable Iron," "Influence of Furnace Atmosphere on the Annealing of Malleable Iron," "Mechanics of Foundry Mechanization," and *Multiple Stack Molding"* are on the Malleable program.

Heading the list of Brass & Bronze Division papers is *"Spheroidal Type Macro-Gas Porosity in 85-5-5-5."*

"The Use of Standards in Controlling Costs" has been scheduled by the Cost Committee.

Pattern Division program plans include a paper entitled *"Patterns for Shell Molding."*

"Developing Standard Data Tables for Core Finishing" and *"Conveyor Molding Standards"* have been scheduled by the Time Study & Methods Committee.

Convention attendants are urged to prepare written discussion of papers to be presented at the 1953 Convention as a convenience to authors and recorders. This year, as in 1952, discussion will not be taken by stenotypists. Instead, committee members will act as recorders at the various sessions, making notes of major points and questions brought out following presentation of the papers and recording names of those who engage in discussion.

BRASS & BRONZE ROUND TABLE LUNCHEON

TUESDAY, MAY 5

Program for the luncheon includes showing of the Brass & Bronze Ingot Institute film on gating and discussion of the questions below. The first question relates directly to the film.

Brass and bronze foundrymen are urged to attend the luncheon and to participate in the informal discussion which, as usual, will not be recorded nor published.

Questions for discussion are:

1. How does the gating system affect the soundness of copper-base alloy castings?
   (a) Do all copper-base alloys follow these principles?
   (b) Does melting practice influence the effectiveness of this gating technique?
   (c) Do molding materials influence the effectiveness of the gating technique?
2. Is it possible to make pressure castings from the aluminum and manganese bronzes?
3. Good practice dictates some standard of quality control in all brass and bronze foundries.
   (a) How can this be set up for small, as well as large foundries?
   (b) Are simple standards of work sufficient?
   (c) Are laboratory facilities required?
4. After making a certain casting for a period of time, a considerable amount of scrap was obtained through no apparent change in practice. Is there a standard correction procedure to follow?
5. What benefits can be derived from the use of oxidizers, deoxidizers, covers or fluxes, when melting?
   (a) Tin bronzes?
   (b) Yellow brass?
   (c) High strength bronzes?
   (d) Silicon bronzes?
   (e) Nickel silvers?

How to standardize and set up

Multiple molding in a malleable shop

JOSEPH G. KROPKA / *Supt., Malleable Div., Chain Belt Co., Milwaukee*

Molder setting the cores in a section of a stack mold.

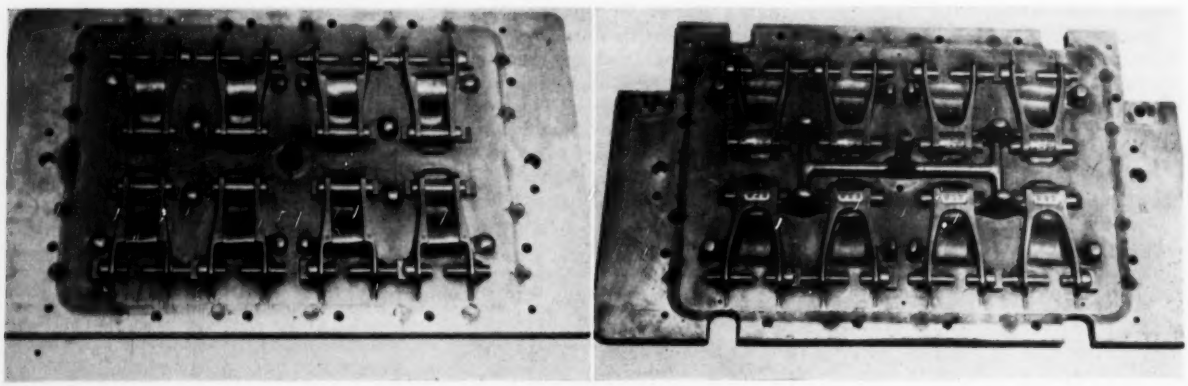
Due to demands for increased production and shortage of skilled foundry labor, multiple stack molding was adopted in the author's plant because of its basic economic factors. The need of continuity of operations for full realization of all possible economies is stressed in this paper. Methods of sand handling, molding, pouring, and shakeout operations are presented. Tests and equipment used are described in detail. Need for standardizing flasks, machines, and molding procedure to meet specifications and production requirements and recommend constant checking to insure quality of products are stressed.

The principle of stack molding is not new. The piston ring industry has used this method of molding rings for years to maintain production at a high level and at a very low cost per casting.

The author confines the description to "multiple" molding methods. This type of stack molding was adopted in our foundry after a series of experiments and studies proved, conclusively, that certain economies could be realized that were impossible to obtain under other methods.

In multiple molding pattern impressions are made in both sides of the mold, which results in one side

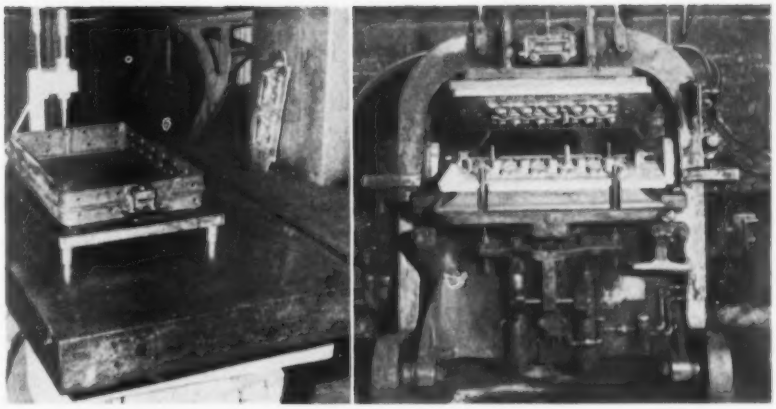
Preprint No. 53-21. This paper will be presented at a Malleable Session of the 57th Annual Meeting, American Foundrymen's Society, Chicago, May 4-8, 1953.



Pressure plates used in stack molding. Drag impressions are made by plate on left, cope plate is at right.

Near right is flask in jig for checking alignment of bushings. Case-hardened bushings minimize wear and insure precision. Straightening equipment is available for putting flasks back into shape if necessary.

Molding machine set up for production of stack mold sections. Patterns on squeeze head will make cavity for drag. Cope patterns are on lower plate.



of the flask being used as the drag and the other as the cope when placed in a stack. The successful use of this method of molding is dependent on a number of factors such as accuracy of pattern alignment, rigidity and alignment of molding machines, proper gating and sprueing, mold hardness, pouring methods, and the proper permeability and temper of the sand used.

While it is difficult to present in this paper all the detailed problems and precautions necessary to have a successful production operation, we will try to cover all the basic equipment and methods that we are employing.

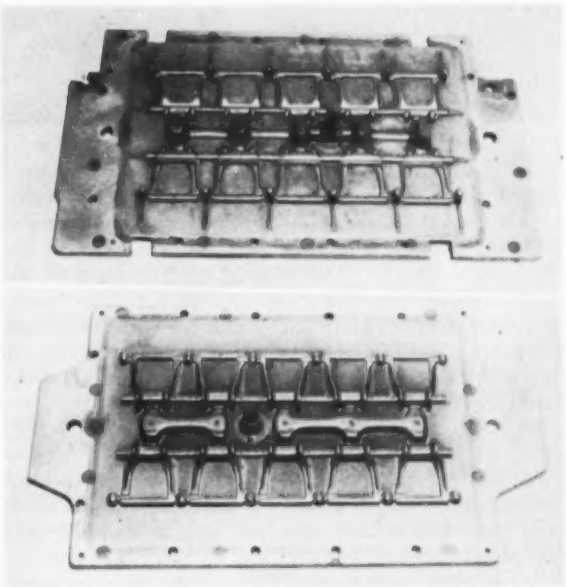
Selecting Molding Machines

The selection of the right type of molding machine to be used in multiple molding is of great importance in the making of good castings. The diameter of the squeeze cylinder must be large enough to give good mold hardness and the jolt solid enough to keep the number of jolts at a minimum. Proper squeezing and packing is necessary for an accurately formed pattern impression.

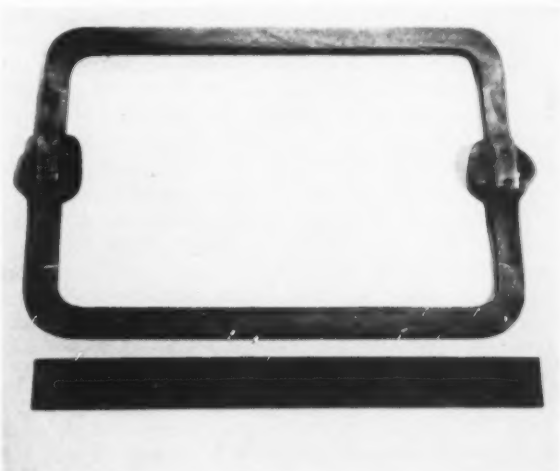
To maintain proper pattern alignment the table of the machine has to be equipped with hardened steel plate guides. The drag pattern is mounted on the platen or top plate of the machine. Upon squeezing, hardened ground guides assure the proper entrance of the drag pattern mounted upon the platen of the machine into the sand and assures a very close tolerance so proper alignment during the squeeze and draw is maintained. The stripping of the flask and sand from the pattern is done by means of four stripping pins contacting the flask flange. Adjustable pins accommodate the change in flask sizes.

Basically, any machine that is manufactured to proper tolerances and provides the necessary hardened wearing parts to prevent "wobble" can be used but care must be used in the selection of a machine so that the type requiring the least number of manual motions is chosen.

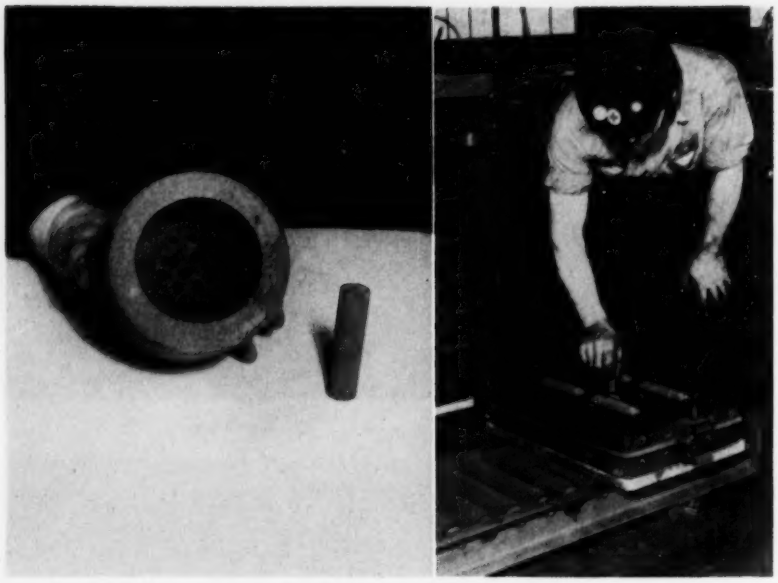
The problem of making pattern equipment for multiple molding is no different than making cope and drag plates. Aluminum pressure plates are used in our multiple molding. In planning of multiple molding equipment, the pattern shop's principal concern is to see that the pattern is dimensionally accurate and sound. Close attention has to be given to gating,



Cope (upper) and drag (lower) plates showing back-feeders and bleeders. Notches (upper) are for lift pins.



Strike-off plate and bar. Thickness and shape of plate, determined by experiment, provide extra sand for drag.



Dry-sand pouring cup keeps metal clean and controls metal flow to help give constant ferrostatic head.

Stop-off core, shown being placed in bottom mold section, plugs sprue hole which is automatically produced in each section by mating sprue cutters mounted on cope and drag plates.

parting, and draft to insure that a full supply of molten metal will properly reach all parts of the mold cavity.

The first step in making pattern equipment consists in making master plates for the table and platen of the molding machines. The table plates are made of cast iron and have dimensions of 28 x 18 x 2½ in. These plates have to be machined so that the surfaces of each plate are parallel to each other. The platen plates are made of steel and are 27 x 17 x 1¼ in. Here again the surfaces must be parallel to each other.

Pattern Equipment Must be Accurate

After the cope and drag patterns have been checked for dimensional tolerances the patterns are machined and rechecked so that when they're placed on the master plates they are parallel and in perfect alignment. This is done by means of jigs and fixtures to insure absolute accuracy. By means of socket head machine screws the plates are now mounted to the table and platen of the molding machine. The mounting is done so that the pattern plates are interchangeable.

The changing of pattern plates from one machine to another is only a matter of minutes, providing the proper care has been exercised in designing a master plate that will accommodate all pattern plates. To make this successful, it is necessary to adopt a universal size that will accommodate all pattern plates, and to do a certain flask size must be selected as standard.

A two-piece sprue cutter is fixed permanently on the pattern. The male part is mounted on the cope pattern. The female part is mounted on the drag. The operation is similar to that of a piston and cylinder action. Accuracy in placing the sprue cutter is required as the common sprue for a stack must be of such nature as to prevent washing or splashing.

In multiple molding selecting the proper type of flask and size is very important. We use two sizes of flasks on our system—13 x 19 x 3 in., and 14 x 20 x 4 in.—and design all pattern equipment to suit so we do not have to change flasks every time we change patterns. These flasks are constructed of special rolled steel channel having a solid center reinforcing rib and full width bearing sand retaining flanges. The copper content is sufficient to make the channel rust resistant.

Bushings are made of steel and cyanide hardened against wear. A round bushing is installed in the lower pin lug at one end of the flask section while an elongated bushing is installed in the lower pin lug at other end of each section. The elongated bushing is lined up exactly parallel with the pin center line due to the use of a flat pin on the lower machine platen.

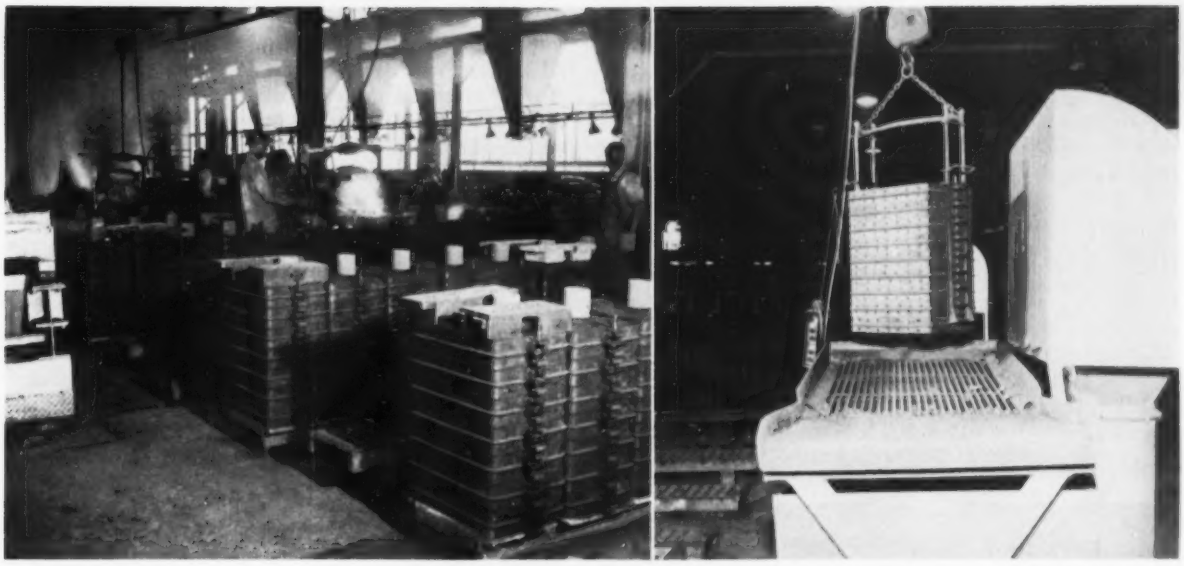
Pins extending 1⅞ in. above parting are used on the 3-in. deep sections, while pins on the 4-in. sections extend 2⅜ in. above parting. Pins are made from standard cold rolled stock steel and are not hardened. Round pins are installed in both of the upper pin lugs of each section and are fastened into the pin lugs by a drive fit. To prevent shifts and yet to give the molder enough play to allow closing the sections without binding a clearance of 0.0065 to 0.007 in. is maintained.

Since metal generates steam and gas when brought into contact with mold and core walls, we vent our flasks with 44 holes, 7/16-in. in diameter in each section.

To keep the quality of castings uniform and the foundry loss at a minimum the accuracy of the flasks has to be checked constantly. Jigs and flask straightening equipment insure good flask equipment. Constant vigilance must be maintained so that this part of the operation is not neglected with the resultant loss in production and increased scrap ratio.

Making the Mold

In making a mold, the flask is placed on the pattern mounted on the table of the machine. The strike-off plate is placed over the flask. The strike-off has holes drilled to fit the pins of the flask to hold it in place. The size and contour of the strike-off and its thickness are determined by experiment and will vary from job to job. Due to variation in parting lines and high and low spots created by various casting designs the amount of sand has to vary to give a good pattern impression and proper mold hardness and density in



Stacks are poured from 300-lb covered ladles suspended from tramrails. Same tramrail is used for shakeout.

the drag or top part of the flask. This is accomplished by means of strike-offs.

The sand is placed in the flask and strike-off frame from an overhead hopper. One or two jolts are used to ram the cope. The excess sand is struck off and the strike-off frame is removed from the flask. The thickness of the strike-off is very important as it determines the amount of sand above the flask line. The head of the machine is now brought forward. Both hands of the molder are now occupied, one holding the squeeze valve, the other the vibrator valve. The table now moves upward to squeeze the drag. If the right amount of sand has been left by the strike-off frame the pattern impression of the drag will be true to pattern dimensions and will provide a sand to sand contact when stacking, preventing fins and runouts. We now have the cope and drag impression made in one flask with the cope cavity on one side and the drag on the other.

Complete Mold Section

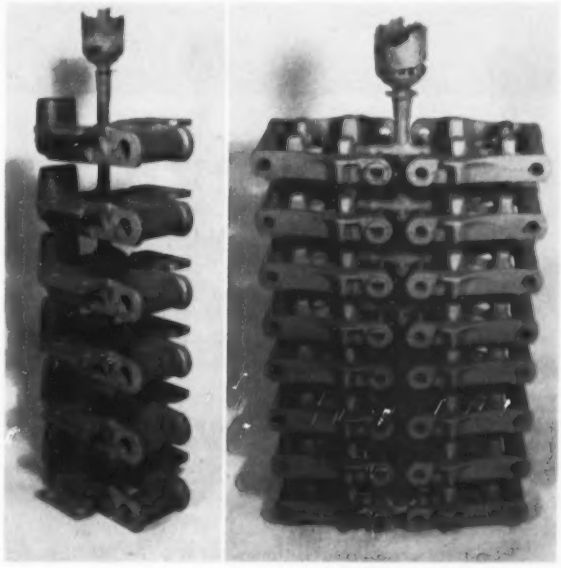
As the table of the machine is lowered after the squeeze, the flask mold rests on the flask strip pins. As the machine head goes back, the mold operation is complete with the exception of the core setting. The complete mold is now placed on an asbestos bottom board. A stop-off core is placed in the sprue hole of the bottom mold to prevent the iron going through the bottom board.

When the flasks are stacked the drag side of each combines with the cope side of the adjoining flask to form a complete mold. This continues until the stack is complete. We stack 7 and 9 high. This gives 6 and 8 good molds since the impression in the upper face of the top mold and the impression in the lower face of the bottom mold are not mated with another cope and drag and therefore are not usable.

A common sprue through the stack supplies iron to each mold runners and casting cavities. To insure uniform flow of hot metal, a dry sand pouring cup is employed. The cup is designed so that a constant head is maintained during pouring and a uniform flow of metal into each mold is insured, with slag or dirt collecting in the pouring cup.

Pouring is done by means of overhead cranes with 300-lb ladles. Iron is brought into the pouring area by means of a tramrail system and transferred into the pouring area. The amount of iron poured into a stack varies from 90 to 175 lb. The time required to pour a stack varies from 20 to 30 seconds. In our type of work the cooling time varies anywhere from 5 minutes to 25 minutes, and this fact must be considered in coordinating the different operations.

After pouring and cooling the molds are ready for shakeout. The same cranes used for pouring are now utilized in shakeout. A special frame is used for holding the flasks while transferring the complete stack of

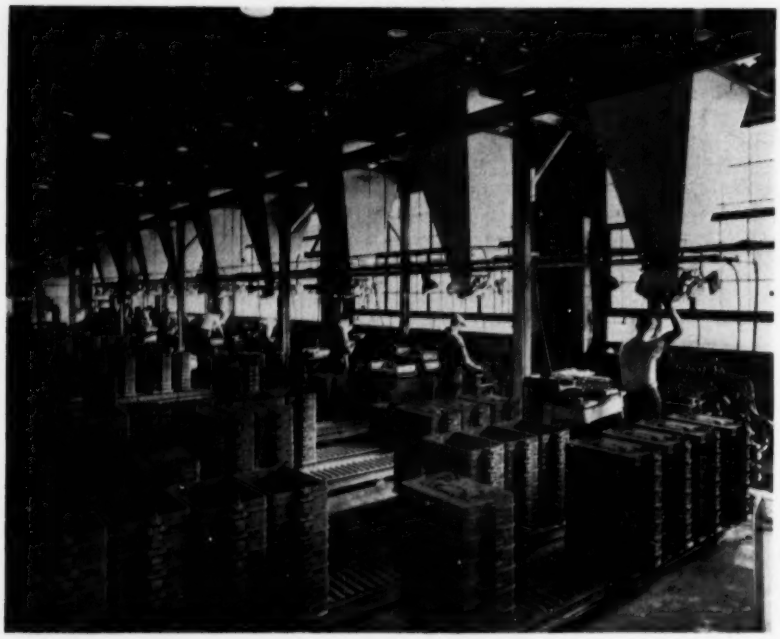


Castings at left weigh 49 lb, sprue and gates 45 lb. Casting weight at right is 59 lb, sprue weight 46 lb.

molds to the shakeout. One shakeout for every three molders was found to be necessary. After the castings are removed from the flasks, the crane hoists the frame and the flasks and places them on the return rolls for return to the molder. The castings fall into a tote box and are hauled away by an electric truck to an area for sprueing at any convenient time.

The use of tote boxes rather than a casting conveyor for handling the castings was dictated by the need of grouping the different types of castings that are almost identical. Also, the use of alloy irons makes sorting too difficult and expensive if they are allowed to become mixed in handling to the cleaning room.

To make molding, pouring, shakeout, and flask return as efficient as possible many methods of mechanization were explored and studied. For molding and flask handling, we found roller conveyors to be most practical, since we have intermittent pouring, and



Nine-man stack molding unit in operation. Sand conditioning unit and operator are at far left. Each molder is served by three roll conveyors, two for stacks, one for flask return. Sand system is "closed" with unused sand coming to end of belt at right being returned for redistribution. Grates in floor under each molding machine eliminate shovelling from floor, permit spilled sand to return to system for subsequent use.

require storage for stacks between heats. Gravity rollers offered the necessary flexibility and in addition allowed enough storage time to take care of the variations in cooling time.

Each molder is supplied with two gravity lines for molds, each 42 feet long, and one return line for empties. The two lines provide holding space for 50 stacks. The average production per man is from 40 to 70 stacks per day, depending on the number of cores in a mold.

To provide the necessary sand to insure a constant rate of production and to take advantage of all possible cost reduction, we installed a sand handling and conditioning system. This insures that uniform sand is delivered when and where desired with a constant check on moisture, permeability, and green strength.

While properly conditioned sand is a "must" in any molding operation, it is doubly important in stack molding. This type of molding requires a sand having good flowability for molding while retaining the proper green strength to prevent washing in the sprue due to the long primary drop of the hot metal when filling the lower molds in the stack. Proper cooling is also a "must" as the ratio of sand to castings is very small with the resultant excessive heating of sand. To accomplish the above, we selected the muller method as best suited to meet our needs.

It is also very important that a sufficient volume of sand is provided to take care of the fluctuations in the amount of sand in use during the "setting out" period between heats. The volume of sand should be large enough so that the "use cycle" does not exceed two times per day to prevent rapid deterioration of the sand and also to allow sufficient time in storage for the sand to equalize in temperature to insure closer control during conditioning.

It then became necessary to design a sand handling system to meet all these basic conditions. The sand falling through the shakeout is carried by a steel pan conveyor to a magnetic belt conveyor where all the tramp iron is removed. The sand is then elevated by means of a bucket conveyor to a hexagonal revolving screen which breaks up sand lumps and removes foreign non-ferrous material. We reclaim about 95 per cent of our core sand and in this way keep the volume of sand constant, the core sand additions making up for the gangway losses. To maintain the grain size in the backing sand, we use the same basic grain size in our cores as we do in our molding sand.

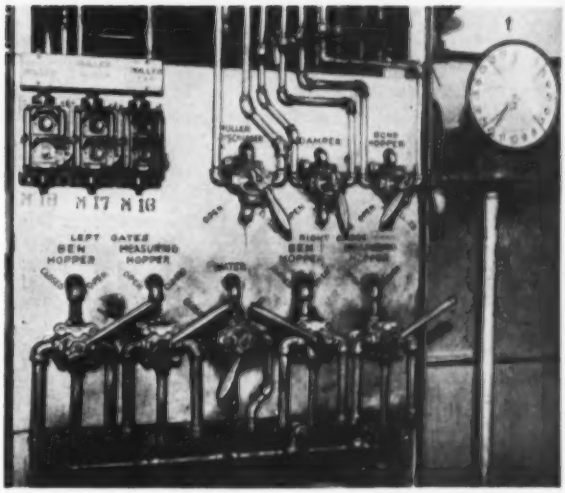
The screened sand falls into a 100-ton bin where it is held about 3 hours giving it a good chance to equalize in temperature. This bin is equipped with thermometers at the discharge openings so that the muller operator knows at all times what temperature he has to cope with. The sand is fed to the muller in regulated batches where it is cooled and the necessary binders, water, and sea coal are added. Amounts are determined by the laboratory sand technician.

The sand is discharged from the muller onto a belt feeder and then elevated by bucket elevator to an aerator set above the distributing belt where it is given the necessary fluffing and aerating. This breaks up any packing or caking so that a light flowable sand is distributed to the molders. The sand is distributed by means of a belt conveyor, with counterweighted V-type plows at each molder's station plowing the sand into the hoppers. The system is a closed circuit type so that any surplus not utilized by the molders is returned by means of an overflow belt to the shakeout conveyor.

Make a Better Place to Work

The hoppers have a capacity of 3½ tons each so that the molding operation will not be interrupted should there be any delay in the conditioning operation. The sand is fed into the flasks by means of manually operated gates rather than power operated as we felt that the amount of sand could be regulated to a closer degree. We have also installed a spill sand belt below the molding machines to remove all strike-off and spill sand so the molders do not have to shovel this sand. Eliminating this operation increases molding production approximately 10 per cent.

Concentrating the pouring operations in a relatively small area creates a smoke and gas condition which must be remedied. Centralized shakeout also creates concentrated gas and dust areas. Betterment of working conditions require the elimination of this smoke and gas. In addition we have a dust problem, fume removal, and cooling of sand, all of which require the use of air.



Control board for sand conditioning system insures efficient, close control of molding sand properties.

It is possible to collect the air from these different operations and vent to the outside except that in our case we are located in a densely populated area where this is impossible. So we installed a dust collector unit. Either a wet or dry collector can be used but ample capacity must be provided.

▸ Select standard sand for shell mold testing

First meeting of the Shell Molding Materials Testing Committee (8-N) was held May 4, 1952, during the 1952 A.F.S. Convention in Atlantic City. Committee officers elected were Harry W. Dietert, Harry W. Dietert Co., Detroit, chairman, and G. A. Conger, Cambria Fdry. & Eng. Div., Stevens Mfg. Co., Ebensburg, Pa., vice-chairman and secretary.

Plan Property Evaluation Studies

The fundamental purpose and function of the committee were defined as "the determination and recommendation of methods and procedures for shell mold properties." To have access to broad facilities and information, committee members were selected from vendors and users of shell mold materials and castings.

The scope of the committee's activities was described as a series of property evaluation programs to be investigated by the committee as a whole. The following programs were enumerated (not necessarily in order of importance) as being of major current interest: (1) Reference Sand; (2) Cured Strength, Hot and Cold; (3) Mixing Procedure; (4) Cured Permeability; (5) Cured Deflection, Hot and Cold; (6) Sample Preparation; and (7) Hardness.

The first problem was the selection of a proper reference sand. Qualifications of the sand were enumerated and committee members, through independent investigations and study of pertinent data, selected Pennsylvania Glass Sand Co., Pittsburgh, as the producer of the reference sand. The sand, selected at the second meeting of the committee December 5, 1952, in Pittsburgh, is called "Tentative 8-N Reference Sand" and will be produced within the following tolerances:

	Between Sieves		Cumulative	
Mesh	%	Tolerance	%	Tolerances
50	1.2	0.5–0.3	1.2	0.5–0.3
70	6.8	0.9–0.4		
100	17.0	1.4–1.1		
140	26.0	1.7–2.1	51.0	0.7–0.9
200	22.0	2.1–1.8		
270	18.0	3.0–2.1	91.0	1.6–1.8
Pan	9.0	1.8–1.6		

The sand is available in 100-lb bags marked with the sand name and production date.

Committee officers at the time of the second meeting were: G. A. Conger, chairman; T. L. Burkland, Deere & Co., Moline, Ill., vice-chairman, and J. B. Frysinger, Pennsylvania Glass Sand Corp., secretary.

Tensile Strength Important

Of greatest interest to members of the committee at the second meeting was the determination of tensile strength. A tentative testing procedure was outlined; deviations for comparative purposes and for possible test improvements were proposed.

As of February 1, 1953, the tensile evaluation program was in full operation. Tentative standards will be available in the late spring of 1953.

Convention preprint ★

Basic cupola operation

Dephosphorization of iron

JACK E. BOLT / *Lt., USNR, Bureau of Ships, Washington, D. C.*

The paper summarizes the results of a research project conducted in partial fulfillment of the requirements for a masters degree and subsequent work by the author at the University of Alabama.

Except for the few but growing number of basic lined cupolas, nearly all the iron melted in foundries of the United States is melted in cupolas with acid linings. While the cupola offers great economy in melting, acid practice cannot affect the removal of two detrimental elements, namely, sulphur and phosphorus.

Actually, the sulphur content normally is increased during acid melting by absorption from coke. Many foundries use some type of post melting treatment for desulphurization and in recent years more progressive foundrymen have turned to the basic cupola for reduction of sulphur. Phosphorus, on the other hand, has for years gone through our cupolas with neither increase nor decrease in content and will do likewise in basic cupolas unless operating conditions are adjusted especially for phosphorus removal.

Years of practice in steel making and the works of Carter,[1] Flinn and Kraft,[2] and others on basic cupolas have given us the principles upon which to base operating conditions for either desulphurization. Fundamentally, desulphurization is favored by hot, basic, and reducing conditions while dephosphorization is favored by lower temperature, basic, and oxidizing conditions.

The exact dephosphorization reaction has not as yet been reliably determined. Phosphorus will oxidize most readily at low temperatures, but without a basic slag containing free lime to hold the P_2O_5 as calcium phosphate in the slag, the P_2O_5 may be reduced again by CO gas returning the phosphorus to the iron as Fe_3P. This latter reaction becomes more prevalent with increasing temperatures.

It was the object of this investigation to study the removal of phosphorus and its dependence on other elemental contents in basic cupola melting. In the first four heats it was desired to show a relationship between phosphorus removal and the degree of oxidation in the cupola by varying coke ratios from 6:1 to 12:1, keeping all other factors constant. The fifth cupola heat duplicated the best apparent coke ratio of the first series using a 50 per cent increase in limestone.

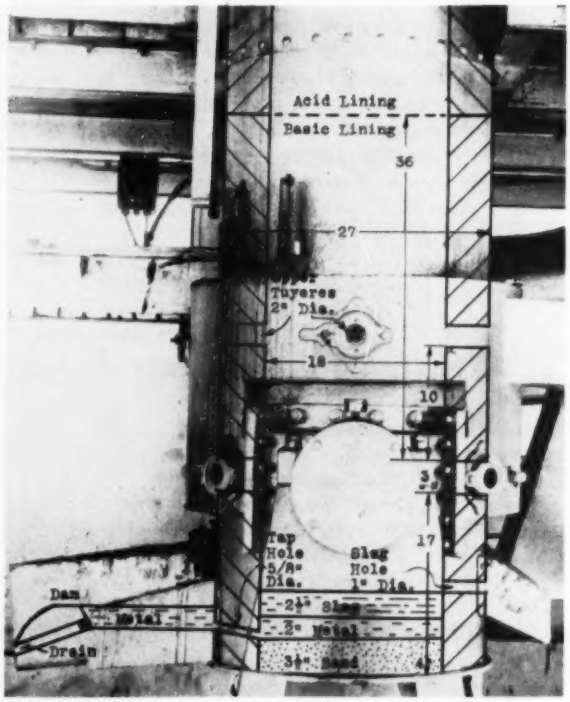


Fig. 1—Details of cupola lining, slag, and metal levels.

Lower Lining Was Basic

The cupola used in this investigation was equipped with an air weight controller and centrifugal fan type blower. The cupola measured 85 in. from the bottom of the base plate to the charging apron. The well and four rows of brick above the lower tuyeres were lined with No. 3 magnesite-chrome arch bricks directly

1. S. F. Carter, "Basic Lined Cupola for Iron Melting," *Transactions, A.F.S.*, vol. 58, pp. 376-392 (1950).

2. R. A. Flinn and R. W. Kraft, "The Importance of Slag Control in Basic Cupola Operations," *Transactions, A.F.S.*, vol. 59, pp. 323-329 (1951).

Preprint No. 53-27. This paper will be presented at a Gray Iron Session of the 57th Annual Meeting, American Foundrymen's Society, Chicago, May 4-8, 1953.

TABLE 1 . . . CHARGE COMPOSITIONS

Heat	Coke, lb	Limestone, lb	Soda Ash, lb	Metal, lb
1	16⅔	8	2	100
2	12½	8	2	100
3	10	8	2	100
4	8½	8	2	100
5	11	12	2	100

TABLE 2 . . . CHEMICAL ANALYSES OF METAL

Heat	Metal Sample	Time after tap-out, min	Spout Temp., F	Composition, per cent				
				TC	Mn	P	S	Si
1	1A01	13	2420	3.50		.282	.184	.30
	1A02	21	2590	3.63	.35	.278	.170	.29
	1A03	34	2600	3.35	.35	.270	.161	.28
	1A04	46	2620	3.55		.262		.25
	1A05	58	2560	3.36	.33	.238	.155	.22
	1A06	69	2580	3.36		.257		
	1A07	80	2560	3.38	.32	.251	.136	
	1A08	91	2520	3.40		.241		
	1A09	106	2540	3.37	.32	.232	.132	.17
	1A10	112	2520	3.28		.223		
	1A11	118		3.23	.27	.215	.133	.14
2	2A01	1	2410	3.64	.32	.286	.197	.32
	2A02	12	2480	3.57	.31	.282	.158	.29
	2A03	27	2580	3.29	.35	.272	.160	.24
	2A04	39	2540	3.42		.248		
	2A05	49	2530	3.35	.34	.238	.149	.19
	2A06	57	2520	3.28		.225		
	2A07	67	2470	3.05		.193		
	2A08	80	2480	3.09	.32	.200	.132	.15
	2A09	88	2460	3.13		.212		
	2A10	99		3.05		.209		
	2A11	101	2420	3.09	.32	.215	.142	.12
	2A12	104		3.16		.189		
	2A13	109	2410	3.14	.32	.218	.139	.13
	2A14	111		3.11	.29	.219	.129	.13
3	3A01	2	2400	3.54	.30	.325	.175	.35
	3A02	12	2560	3.60	36	.303	.140	.39
	3A03	22	2610	3.50	.34	.278	.129	.30
	3A04	32	2570	3.46		.272		
	3A05	42	2580			.250		
	3A06	52	2590	3.44	.28	.245	.124	.21
	3A07	62	2570			.223		
	3A08	72	2560	3.19		.188		
	3A09	82	2540			.182		
	3A10	92	2520	3.05	.24	.182	.129	.13
	3A11	102	2420			.147		
	3A12	109	2410	2.69		.149		
	3A13	112				.145		
	3A14	115		2.78	.23	.151	.138	.12
4	4A01	1	2520	3.54	.33	.319	.206	.26
	4A02	11	2500	3.52		.299	.178	.23
	4A03	21	2540	3.53	.30	.287	.164	.23
	4A04	31	2550			.275		
	4A05	41	2550	3.29		.225	.141	.20
	4A06	51	2480			.231		
	4A07	61	2480	3.24	.24	.180	.143	.12
	4A08	71	2480			.200		
	4A09	76	2450	3.06		.182	.131	.11
	4A11	81	2420	3.02	.20	.179	.133	.10
	4A12	83	2440			.182		
	4A13	85	2470*	2.95		.182	.141	.12
	4A14	87		2.98	.20	.189	.136	.12
5	4A01	1	2480	3.60	.32	.33	.216	.36
	4A02	11	2580	3.62		.30	.165	
	4A03	21	2620	3.47	.32	.255	.145	.29
	4A04	34	2620			.288		
	4A05	41	2550	3.33	.32	.211	.153	.20
	4A06	51	2560			.193		
	4A07	61	2500	3.20	.29	.165	.130	.13
	4A08	71	2410			.163		
	4A09	81	2390	2.93	.17	.108	.134	.09
	4A10	90		2.73	.15	.104	.148	.07

*Taken after drain plug was opened; represents cupola well temperature.

against the 27-in. shell resulting in an 18-in. inside diameter. Acid bricks were used to complete the lining.

Figure 1 shows the details of levels and lining inside the cupola. The height of the dam was raised 1 in. over the inside iron level to counteract the blast pressure. Operation was continuous tap, back slagging without interruption after the blast was turned on for each of the heats. This method was chosen in order to maintain constant slag and metal levels.

Every effort was made to insure that all heats were run exactly alike except for the desired single variable per heat. Tempered heap sand was used for the cupola bottom. Wood was used for lighting the bed, and a 4-hr burn-in time was used. The final bed height, 52 in. above the top of the lower tuyeres, was considered the minimum for this cupola to give a satisfactory tapping temperature. Charging started on a closely controlled time schedule using the sequence of coke, flux, and metal with no limestone and fused soda ash on the first two charges. Table 1 shows the charges per heat with the exception that the coke charges on all heats were maintained for the first five charges at the 6:1 ratio, or 16⅔ lb per charge to insure molten metal at tap out.

Coke was screened to 3 x 2 in. size, soda ash blocks were crushed and placed in paper bags with limestone, and the metal charge was of very uniform block size, 1½ x 3½ x 4 in., of the following chemical composition: C, 3.45-3.55 per cent; Si, 0.50-0.55; Mn, 0.50-0.55; S, 0.14 max; and P, 0.28-0.33.

Changes in Composition

Care was taken to see that each charge was placed level in the cupola and that the cupola was kept full at all times. It was considered that the first hour after tapping would be required for equilibrium conditions to be reached inside the cupola and that the runs should continue for one additional hour giving a total melt of 3000 to 3700 lb dependent upon melting rate. This was accomplished on all but the last two heats which will be discussed later.

Tables 2 and 3 show the chemical analyses of both metal and slag samples taken during each heat.

Figure 2 is a summary of curves showing the chemical analyses for the elements phosphorus, silicon, total carbon, manganese, and sulphur, along with the metal temperature at the spout, each plotted against time in minutes after tap out.

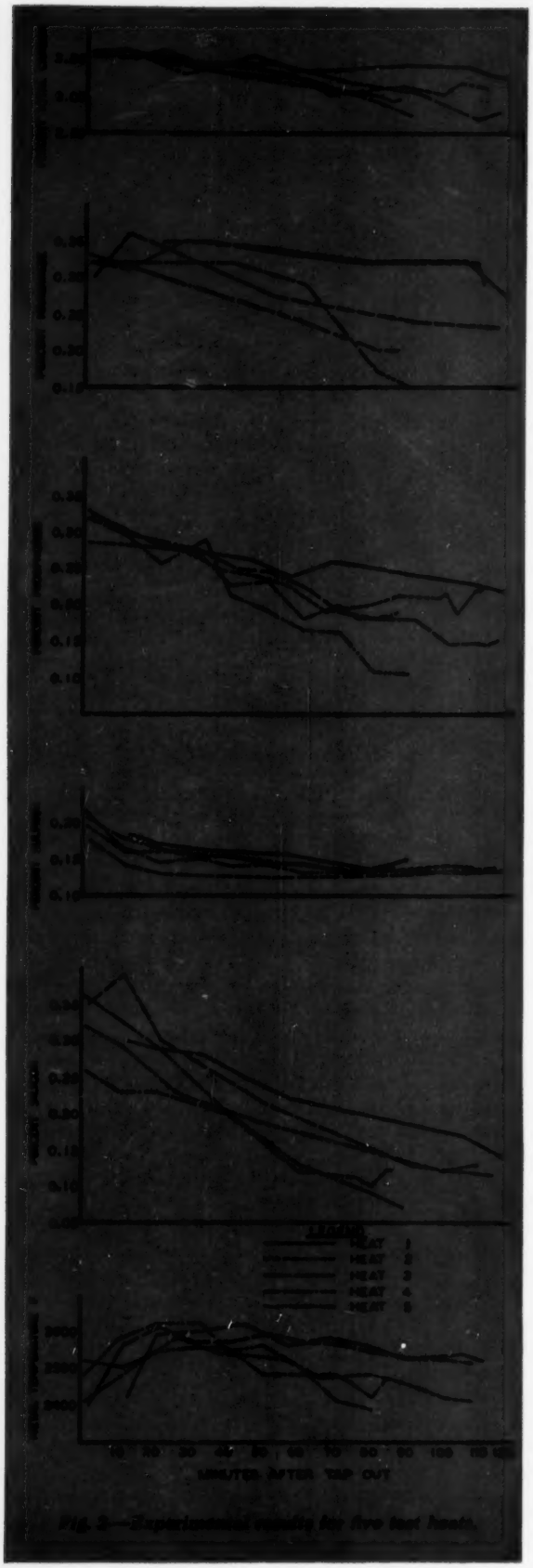
For all the elements with the exception of total carbon, the ordinates, or percentages, are plotted at the same scale to facilitate comparison.

The abscissa, or time scale, is comparable for all curves.

Below is listed each element followed by a brief discussion of its relationships under the conditions of this experiment.

Sulphur: All heats show sulphur pickup from the bed coke with analyses ranging at tap-out from 0.175 per cent for Heat 3 to 0.216 per cent for Heat 5 with the charge metal containing from 0.11 to 0.14 per cent sulphur.

Little effective desulphurization was obtained as the curves for all heats level out at approximately charge level. This does indicate, however, that there was some



desulphurization since sulphur pickup from the coke was eliminated. This may be verified by the sulphur content in the slag analyses. Of particular interest is the upswinging trend in sulphur content at the ends of Heats 4 and 5 when the metal temperatures were very low.

Manganese: At tap-out, the manganese contents ranged from 0.30 per cent for Heat 3 to 0.33 per cent for Heat 4 with the charge metal at 0.50-0.55 per cent. Heats 1 through 4 show progressively more oxidation with little difference between Heats 1 and 2. The proximity of manganese contents in Heats 1 and 2 does not preclude the assumption that the latter was under more oxidizing conditions considering that silicon, which takes precedence over manganese in oxidation,

TABLE 3 . . . SLAG COMPOSITION

Heat	Sample	CaO	MgO	Al_2O_3	SiO_2	S	P_2O_5	FeO	Fe_2O_3	MnO
1	1A04	16.50	11.18	24.38	41.70	.19	.17	2.60	.48	3.17
	1A06	24.90	10.72	21.28	37.30	.36	.50	1.80	.32	3.39
	1A08	25.65	18.20	12.50	34.60	.33	.99	3.45	.56	4.15
	1A10	26.20	9.00	22.48	34.00	.45	1.02	2.75	.56	4.10
	1A13	27.70	18.60	11.68	31.90	.55	1.07	3.75	.40	3.60
2	2A07	20.20	13.30	14.80	34.00	.28	1.84	9.07	.56	4.97
	2A09	22.80	16.50	13.00	31.24	.22	1.76	8.35	1.20	4.64
3	3A04	12.10	12.65	23.50	37.90	.12	.47	7.60	.64	4.45
	3A05	15.80	14.10	19.44	39.84	.20	.61	5.25	.32	4.48
	3A06	18.90	15.40	16.62	38.36	.19	.81	3.82	.48	4.67
	3A09*	19.15	16.38	17.20	40.46	.22	.22	1.87	.32	3.40
	3A10	21.00	15.20	13.20	20.96	.43	3.48	15.40	3.82	5.32
4	4A03*	14.30	15.30	18.30	40.80	.13	.63	4.70	.49	4-5%
	4A06*	16.60	15.85	14.87	35.80	.23	1.67	8.30	49	on
	4A09	18.45	17.26	12.50	29.80	.36	3.18	12.50	.36	all
	4A14*	20.25	16.05	14.33	39.30	.30	.85	2.05	.30	(est.)
5	1B06*	14.25	14.60	21.30	40.40	.16	.29	3.20	.32	3.50

*Slag sample taken from metal spout after coming through tap hole.

was at a consistently lower level when comparing Heat 1 with Heat 2.

Silicon: At tap-out, silicon ranged from 0.36 per cent for Heat 5 downward to 0.26 per cent for Heat 4 while the silicon charged ranged from 0.50-0.55 per cent. Each of the first four heats generally showed progressively more silicon oxidation. The curves for Heats 2 and 3 did not assume their respective positions on the graph until well after the estimated time for equilibrium conditions to be established. However, the curves do approach each other until they cross. Heat 3 started at a higher silicon level and the over-all silicon loss was greater than in Heat 2. Heat 5 shows a consistently low silicon level with a low of 0.07 per cent at 90 minutes which condition greatly facilitates the removal of phosphorus.

In every heat the oxidation loss was greater for silicon than for manganese.

Total Carbon: The percentage scale on this curve is one-tenth the magnitude used for the other elements to avoid a prohibitively large graph.

Carbon content at tap-out ranged from 3.50 per cent for Heat 1 to 3.64 per cent for Heat 2. This generally showed little effective carbon pickup from the bed coke since the charged metal contained from 3.45 to 3.55 per cent carbon.

With a few exceptions, the carbon curves lie in the same relative positions as those for silicon at any particular time. Throughout the middle portion of the curves, as is the case for silicon, Heat 2 is at a lower level than is Heat 3 and the points at which these two curves cross is within 3 minutes of each other on the time scale.

This apparent reversal in the early portions of both the carbon and silicon curves for Heats 2 and 3 is attributed to a slightly lower dam height and consequent lower metal temperatures in Heat 2. Even though Heat 3 maintained relatively high metal temperatures in the later portion of the heat, the curves for total carbon, silicon, and manganese assume their correct relative positions illustrating that there was progressively more oxidation in each of the heats from Heat 1 through Heat 4. Again it is stated that this was the desired relationship to be obtained by decreasing the coke charge weight on each successive heat in order to observe the resultant effects upon dephosphorization.

Phosphorus: At tap-out, phosphorus percentages for all heats lie within the limits of the metal charge, 0.28-0.33 per cent. It is significant that during the period from 10 to 35 minutes after tap-out, all four curves on the progressive oxidation series lie within a spread of 0.02 per cent before they diverge while Heat 5 started at the highest phosphorus level and continued downward at the most favorable rate. In the middle portion of the heats the greater dephosphorization in Heat 2 as compared to Heat 3 may be explained by the relationship of silicon content and metal temperatures for the two heats. In this portion, Heat 2, as compared with Heat 3, had both a lower metal temperature and silicon content, both of which aid in the dephosphorization reaction.

Soon after the assumed time for equilibrium inside the cupola the phosphorus curve for Heat 3 drops below that for Heat 2 meaning greater dephosphorization at which time the silicon contents for the two heats are almost identical.

Reach Lowest Phosphorus

Of the progressive oxidation series, Heat 3 reached the lowest phosphorus level which was consistently between 0.145 and 0.151 per cent amounting to a removal of approximately 50 per cent of the phosphorus charged. This is considered to be more than a spot check since the four analyses within this minimum range were spread over a period of 13 minutes during which time approximately 350 lb were melted.

Heat 5, repeating the coke ratio used for Heat 3 and with 50 per cent more limestone, showed a consistent drop in phosphorus content ending at a low of 0.104 per cent amounting to a removal of approximately 68 per cent of the phosphorus charged. Here nearly all the metal melted after the first hour, roughly 800 lb, contained less than half of the phosphorus charged.

Heats 4 and 5 ended short of the desired operating time of two hours. With operations designed for the lowest possible fluid metal temperatures, the tuyeres finally choked off the incoming blast until the cupola froze. Punching the tuyeres to keep them open was futile as the accumulation of slag and frozen metal droplets was quite dense.

It is noted that the acid constituents of the slag are relatively high in comparison to bases and not by any accepted method of calculating slag basicity can a basic slag be assumed.

It is highly possible that these heats did not continue long enough and did not have sufficient slag fluidity to flush out the acid slag constituents resulting from the bed coke ash and oxides formed during melting before the slag hole was opened. Attempts were made to obtain slag viscosimeter readings, but the flow was never maintained long enough to take reliable readings. Consequently it is not ascertained whether or not the slag samples recorded are representative of conditions inside the cupola.

Analyses were made of slag samples taken from various locations inside the cupola and from the bottom drop, but the results were not sufficiently consistent to report.

Spectographic analyses of slag samples failed to reveal any more than very small percentages of sodium from the soda ash (Na_2CO_3) charged.

Conclusions

Conclusions based on this study are:

1. Phosphorus can be removed in the basic cupola.
2. Phosphorus removal increases with increasing oxidation in the range covered by this study.
3. Phosphorus removal is facilitated by lower silicon content in the metal.
4. Phosphorus removal is facilitated by lower metal temperature.
5. Phosphorus removal is facilitated by a higher percentage of limestone charged in the range covered by this study.
6. Phosphorus removal is possible without excessive carbon oxidation.
7. More silicon than manganese is oxidized in basic cupola operation.
8. Limited desulphurization occurs with dephosphorization.
9. Refractory burn out is low at the low melting temperatures used, but the fusion of slag to the brick results in considerable brick loss when chipping out.
10. Ladle handling or pouring castings with the low temperature metal coming from the cupola spout is impractical. Duplexing or remelting is essential.

It seems logical to assume that in basic cupola operation using insulation between the shell and basic brick lining, and sufficient coke to maintain slag and metal fluidity, successful dephosphorization can be accomplished on a production basis.

Acknowledgements

The author wishes to express his appreciation to Warren C. Jeffery for his invaluable assistance throughout the performance of the investigation and for his review of the results, to the students who aided in making the cupola runs, and to E. C. Wright and N. N. Engel of the University of Alabama Metallurgical Engineering Department where the work was performed. Grateful acknowledgements are also extended to R. A. Flinn, University of Michigan, and America Brake Shoe Co., Mahwah, N. J., for assistance and for the chemical analyses.

Convention preprint ★

Practical foundry applications of principles of ratio gating

L. L. LUCAS / *Wagner Mfg. Co., Sidney, Ohio*

This article describes experiments and actual applications of ratio gating used on several hundred thousand castings of aluminum-base alloy cooking utensils produced by Wagner Manufacturing Co., Sidney, Ohio. This gating procedure was reported by the Battelle Memorial Institute, Columbus, Ohio, in research for the Light Metals Division of A.F.S.

All of the castings produced in our plant are cast in sand, a blend of two naturally bonded types. The composition is controlled to insure proper strength and permeability, with a moisture content of approximately 4.5 per cent. All molding is done in tight, steel flasks with an average size of approximately 13 x 19 in., using a 5-in. cope and a 2½-in. drag.

The alloy produced, an aluminum-base type, contains approximately 4.5 per cent magnesium and 2 per cent silicon, with enough titanium added to insure a very fine grain structure. It is melted in 600-lb, gas-fired furnaces, with rigid control of such items as cleanliness of melting pots, temperature of metal, preheating of chill bars, loading of furnaces in such a manner that all ingots and returns are preheated before reaching the molten bath, cleaning of metal after becoming molten, and avoiding turbulence of metal as much as possible in transfer from the furnace to the mold.

All castings are finished with a clear, high-luster polish. Cross-section thickness varies from ⅛ to ¼ inch. To achieve this excellent finish, it is imperative that castings be relatively free of dross inclusions, large gashole porosity, hydrogen or pinhole porosity, and shrink porosity. If castings are not of this optimum quality, rejects and rework will result.

By following carefully the foundry practices described, it is believed that the metal produced is as free of dross and gas as possible. In our experience, these practices are as essential as any gating or molding technique.

At present, 27 different patterns on which ratio gating has been used are in production. Castings from these patterns vary in weight from 1 to 8 lb, and vary in surface area from 87 to 438 sq in. Through experiments on various patterns, it was found advantageous not only to vary the ratio between the cross-sectional area of the runner and total area of the gates, but also to employ more than one sprue, depending upon the size of the casting. Furthermore, it was beneficial to employ a sprue with a very small area at the base. In our practice, the sprue diameter is ½ in. at the bottom and tapers to 1 in. at the top. On all castings, the gate is very thin—⅛ in.

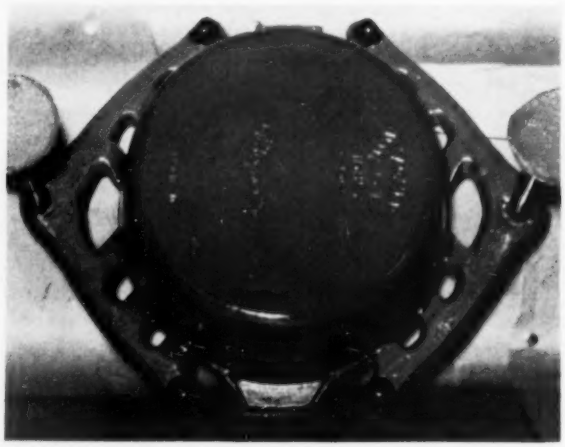


Fig. 1—Cope view of early gating system for 10-in. diameter kettle. Runner is in cope, sprue tapered.

Two particular castings have been selected for detailed discussion in this paper. Photographs have been prepared to record the history of gating used.

Development of Gating Practice

The dimensions of the first kettle casting studied were: diameter, 10 in.; depth, 5 in.; side walls, approximately ⅛ in. thick; bottom section, approximately 3/16 in. thick. All castings are designed with a back draft extending to within 1 inch of the bottom of the casting. The bottom inch of the casting, which is the open end of the kettle, is in the drag, and the remainder of the casting in the cope. This arrangement causes the metal to fill the drag section first, then rise 4 in.

Preprint No. 53-42. This paper will be presented at a Light Metals Session of the 57th Annual Meeting, American Foundrymen's Society, Chicago, May 4-8, 1953.

to fill the side walls, and finally flow across the top of the casting to form the bottom of the kettle.

The gating system is illustrated in Fig. 1; runner and gates are in the cope. The gating system consists of two round tapered sprues with double-runner systems from each sprue and a total of 12 finger gates. The dimensions of this particular gating system are: area at the base of the sprue, 7/16 sq in. tapering to an area of 1¼ sq in. at the top; cross-sectional area of each runner, 9/16 sq in. (¾ x ¾ in.). This produced a gating ratio of 1:2.6:1.3; cross-sectional area of each gate, 3/16 sq in. (3/16 x 1 in.).

This practice resulted in many rejects and rework because of large gasholes and surface inclusions. Although the practice had been used for several years, it is now apparent[1,2,3] that imperfect castings were a result of the manner in which the metal entered the mold.

The first beneficial change from this practice was effected when the shape of the sprue was changed from a round to a rectangle measuring ½ x 1¼ in. at the bottom and tapered to ¾ x 1½ in. at the top. A 1-in. deep sump was incorporated directly under the sprue. The depth of the runner was increased from ¾ in. to 1 in. and it was placed in the drag. The runner completely surrounded the casting and the finger gates were connected to form a 3/16-in. thick slit gate, as illustrated in Fig. 2. This produced a gating ratio of 1:1.3:6.2. This method of gating eliminated much of the trouble from misruns, and, at the same time permitted the pouring temperature to be lowered considerably.

Turbulence Trouble

With these changes improvements were noted, but the human element in the actual pouring of the metal into the molds was still present. Carelessness at any time on the part of the pour-off team would result in losses, which were thought to be caused by the large size of the sprue and the large area of the gate. The increased size of the gating system made it possible, through mishandling of the metal, to create turbulence at the base of the sprue and in the metal as it entered the mold cavity.

At about this time, the results of the A.F.S.-sponsored investigation at Battelle Memorial Institute on gating techniques were published.[1,3] After viewing the motion-picture film, on 1:4:4 ratio gating,[2,4] this type of gating practice was applied to a pattern as shown in Fig. 3a and 3b. The use of a rectangular sprue was continued. The runner was reduced in cross-sectional area as each gate was passed. The gate was also restricted to a large degree at the base of the sprue to minimize turbulence in the runner. Finger gates were used with all approaches well rounded to avoid any radical change in flow pattern. A round sump, about 1½ in. in diameter and deeper than the runner itself, was incorporated directly below the base of the sprue as is evident in Fig. 3b. A loose roll or ball of steel wool, which acted as a partial strainer, was employed in the sump.

This particular gating technique proved to be a great improvement over any practice adopted thus far. However, difficulty at two locations in the casting caused the majority of reworks. A fairly large percentage of castings contained dross inclusions at the first finger gate from the sprue. Also large gas porosity had been forced to the top of the casting directly opposite the sprue. A small percentage of misruns still occurred.

A study of scrap and of the design of the gating system led to the conclusion that additional changes must

Fig. 2—Drag view of kettle shows first improvement in gating. Runner is in drag, slit gate in cope, large, rectangular, tapered sprue is employed.

Fig. 3a and 3b—Cope view (3a) of second improvement, shows finger gates in cope, runner in drag. Runner was decreased at sprue base and as each gate was passed.

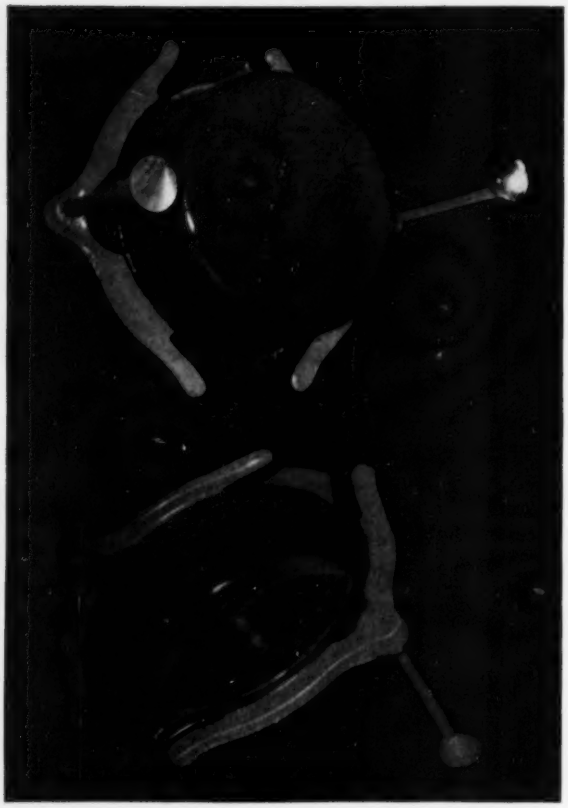


Fig. 4a and 4b—Present standard gating for 10-in. kettle. Two ½-in. diameter, tapered sprues are used, runners are in drag, ⅛-in. slit gates in cope.

be made to guard against the mishandling of metal on the part of some pour-off teams. The solution to this, it was believed, was to attempt to slow down and quiet the flow of metal before it entered the runner, but still maintain enough pressure to run the casting.

Experiments were started on using as small a sprue as possible with correctly proportioned runner and gates which would not result in an excessive number of misruns. As a result of these experiments, the diameter at the base of the sprue was made ½ in. and the sprue tapered to a diameter of 1 in. at the top, as illustrated in Fig. 4a and 4b. It was interesting to note that the older, experienced foundrymen were difficult to sell on the idea that the percentage of misruns would not increase as a result of running the casting through so small an opening. Actually, it was possible to decrease the pouring temperature by 100 F and at the same time reduce the number of misruns to a negligible value. Experience proved that it was practically impossible to pour metal into this sprue without choking it. This choking of the sprue eliminated some turbulence and exerted automatic control over the pouring rate.

With the sprue design shown in Fig. 4a and 4b, it was believed that turbulence of metal entering the runner would be at a minimum at all times. It was realized, however, that the pouring of metal directly into the sprue is considered bad practice, and will create some oxides and gas which may pass into the runner system and into the casting. With this in mind, the

Fig. 5—Long kettle (12¾ in.) formerly had this gating system with runner in drag along with ¼-in. slit gate. Two large, rectangular, tapered sprues were employed.

runner was extended about 2 in. beyond the far edge of the slit gate. Because this runner is in the drag, it must be filled before any metal can reach the casting. It was assumed that the first metal poured into the sprue would be the more seriously contaminated, and this contaminated metal would remain in the extension of the runner. Again, experience indicated that this runner extension served its purpose, even though some oxide inclusions apparently still entered the casting. These inclusions did not constitute a serious problem because they were small and not numerous.

To obtain the 1:4:4 gating ratio on this particular casting, it was apparent that it was impractical to use finger gates. Because of the limited space, the finger gates would, of necessity, have been $\frac{3}{16}$ in. thick or thicker, thus obviating any skimming action. Since we believed there should be a skimming action of the metal while passing through the gate, the finger gates were eliminated and the desired cross-sectional area was obtained by using a slit gate ⅛ in. thick. This thin gate, it was believed, not only caught more oxide particles, but also had a tendency to minimize further any turbulence that may still be in the runner at the time the metal starts to rise in the casting.

Use Ratio Gating Throughout Shop

This type of ratio gating has been applied to all of our patterns, in all instances employing the ½-in. diameter tapered sprue and the ⅛-in. thick slit gate. The gating ratio has been increased or decreased according to the surface area of the casting, using ratios as low as 1:3:3 for the small castings and as high as 1:7:7 for the larger castings. The number of sprues was increased from 2 to 4 on two of the larger patterns, but, in these instances, the ratio was reduced to not less than 1:4:4.

A second type of casting will be described briefly because the principles illustrated in Fig. 4a and 4b apply. In the past, the second type casting, shown in Fig. 5, had a greater scrap loss record than the round kettle described earlier. The larger kettle measured 9¾ in. in width, 12¾ in. in length, and 4⅝ in. in height.

Note in Fig. 5 that the casting was completely surrounded by a heavy runner which was in the drag.

This fed a slit gate ¼ in. thick, located in the cope. The runner was fed by two large, rectangular, tapered sprues with a round sump directly below each sprue. The dimensions at the bottom of the sprues were ½ in. x 1¼ in. A small roll of steel wool was used as a strainer in the sumps. In this instance, a ratio of about 1:1.8:3.9 was obtained. This method of gating proved to be far superior to our previous methods of gating, which had incorporated the runner and finger gates in the cope and was fed by round, tapered sprues.

The present gating ratio of 1:7:7 is illustrated in Fig. 6. The sprue was tapered and had a diameter of ½ in. at the bottom, and the slit gate was ⅛ in. thick. The sump directly below the sprue was eliminated. In this case, with a shallow drag section, the mold hardness was too high at the location of the sump. When permissible, incorporation of a sump as illustrated in Fig. 5, is believed to be beneficial.

Because the sump was eliminated, the steel wool screen was also eliminated. Steel wool screens were, no doubt, helpful, but if they can be avoided, costs can be reduced and iron pickup can be obviated.

Fig. 7 shows a cross section of the old type gating system employing the rectangular sprue. Fig. 8 shows a cross section of the present gating system and a round, tapered sprue. Note the difference between cross-sectional areas of these two sprues.

Improvement in Yield

Rejects and rework on castings, after finishing from the pattern for the round kettle with the gating system shown in Fig. 1, were approximately 50 per cent. After finishing from the same pattern gated as in Fig. 2, rejects and rework on castings were reduced to approximately 25 per cent.

Rejects and rework on castings, after finishing from the same pattern with the present standard gating practice as illustrated in Fig. 4a and 4b, are approximately 8 per cent. An increase in yield of 10 per cent was achieved over that obtained when using the gating system shown in Fig. 2.

Rejects and rework on castings, after finishing from the pattern for the elongated kettle with the gating system shown in Fig. 5, ranged from 35 to 40 per cent. Rejects and rework on castings, after finishing from the same pattern with the present standard gating system illustrated in Fig. 6, are approximately 9 per cent. This represented an increase in yield of 12 per cent.

It was not possible to maintain this high increase in yield on all patterns. It was possible to achieve an over-all average increase in yield of 5 per cent on all castings by employing these improved gating techniques.

These figures on decreased percentage of losses do not paint a complete picture of the improvements made possible by these gating techniques. The number of castings that are returned for salvage work because of gas holes is now about 75 per cent less than with the earlier gating methods. Seldom more than one gas hole is found in any casting; even then, the gas hole is usually very small and readily repaired. The appearance of the castings has improved greatly as a direct result of the absence of scattered dross on the finished surfaces.

Summary of Present Practice

In reducing the area at the bottom of the sprue, which was proved to be necessary in our process, the possibility of misruns was increased. To minimize misruns, all castings are poured with not less than two sprues which have separate runner systems. This practice eliminates possible trouble from misruns and pro-

Fig. 6—New gating for long kettle. Dimensions and locations of sprues, runners, and gates are as in Fig. 4.

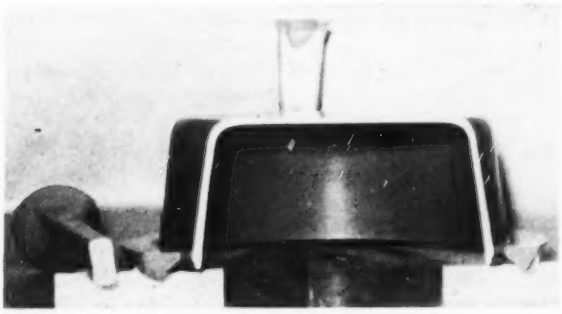


Fig. 7—Vertical section shows early gating system for 10-in kettle. Compare sprue size and casting.

Fig. 8—Improved gating system for 10-in. kettle is shown in section. Note difference (from Fig. 7) in sprue.

vides a more uniform flow of metal up to and over the flat top of the casting.

These experiments and their results apply exclusively to the casting of kettles. No claims are made that the practices or gating techniques described are perfect. They were developed on a trial-and-error basis, and undoubtedly, would have to be changed somewhat when adapted to other types of castings. It is the opinion of the author that ratio gating is a sound method to start re-gating of a casting. Once the correct proportions are reached, there should be a noticeable decrease in rejects.

Acknowledgements

The gratifying results reported in this paper were obtained as a result of the help of such able men as T. D. Stay, T. D. Kramer, R. B. Elliott, and others. Thanks are given to the Wagner Manufacturing Co. for permission to publish this paper.

Bibliography

1. R. E. Swift, J. H. Jackson, and L. W. Eastwood: "A Study of the Principles of Gating," *Transactions, A.F.S.*, vol. 57, pp. 76-88 (1949).

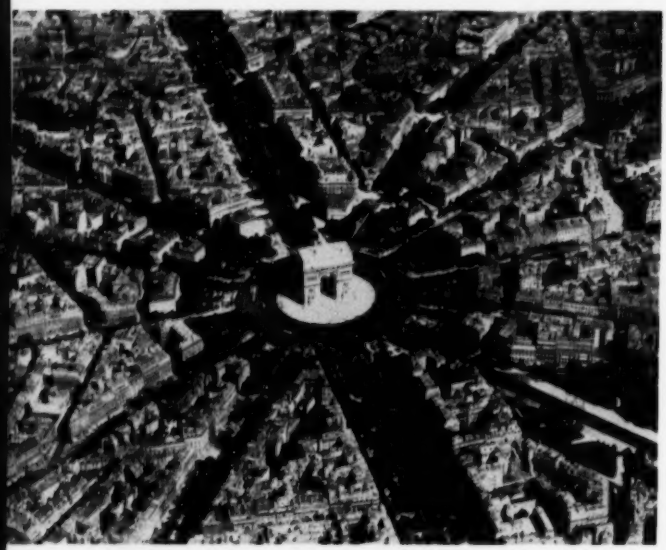
2. "Study of the Principles of Gating," 16-mm, silent, black and white motion-picture film issued in 1949, and obtainable through A.F.S., 616 S. Michigan Avenue, Chicago, Ill. Script accompanies film.

3. K. Grube and L. W. Eastwood: "A Study of the Principles of Gating," *Transactions, A.F.S.*, vol. 58, pp. 76-107 (1950).

4. "Gating for Improved Casting Quality," 16-mm, motion-picture film in color and sound issued in 1950, and obtainable from A.F.S., 616 S. Michigan Avenue, Chicago 5, Ill.

Announce tentative 1953 International program

With scores of American foundrymen planning to attend the International Foundry Congress in Paris September 19-26, a tentative program for the Congress was recently received from the sponsoring organization, Association Technique de Fonderie de France. The program, prepared under the direction of the president of the French Association, P. Muguet, calls for registration on September 19 and 21, technical sessions and ladies entertainment through the week and the main banquet closing the Congress proper on Saturday, September 26. The week of September 27 will be devoted to plant visits arranged for those attending the Congress.



Arc de Triomphe, historic attraction foundrymen will see in Paris during the 1953 International Congress. Several hundred from the United States are expected to attend.

Included in the program will be a visit to the Laboratory of the Centre Technique, the French foundry center in Paris, meetings of the International Committee of Foundry Technical Association, and several official or organized luncheons and dinners through the week. The program on Sunday, September 20 involves a special trip to Ile de France and the Cathedral of Notre Dame. Details of the ladies program have not yet been announced, but will be fully in keeping with the beauty and interest of Paris.

Tentative Program

Sat., Sept. 19 – Registration of participants and families, reception by the Congress Committee of the French Foundry Association evening drive through the city.

Sun., Sept. 20 – Organized breakfast and motor trip to Ile de France.

Mon., Sept. 21 – Registration continued, official opening session of Congress at 9:00 a.m., organized luncheon, technical sessions, dinner and entertainment. Ladies program.

Tue., Sept. 22 – Technical sessions and luncheon. Ladies program.

Wed., Sept. 23 – Technical sessions, luncheon, shop visits, meetings of International Committee. Sightseeing and luncheon for ladies in Paris vicinity. Invitational dinner of International Committee.

Thur., Sept. 24 – Technical sessions, luncheon, shop visits, official reception, visit to Louvre, Museum. Ladies program.

Fri., Sept. 25 – Technical sessions, luncheon, visit to Centre Technique, reception by CTIF. Ladies program.

Sat., Sept. 26 – Technical sessions, luncheon, official closing of Congress. Official closing banquet, dancing and entertainment.

Sun., Sept. 27 – Program for participants and families not yet announced.

Mon., Sept. 28 – Participants leave on week of plant visits and tours.

A full program of functions and entertainment for the ladies is being developed and although not yet announced will include visits to world famous museums of Paris, fashion houses, art galleries, etc. These trips will show why Paris is called "The most beautiful city in the world."

Convention preprint ★

Foundrymen can't know too much

About practical heat transfer . . . Part 2

WILLIAM S. PELLINI / *Chairman, A.F.S. Heat Transfer Committee*

This is the last half of a report interpreting the results of the first eight years of heat transfer research carried on under the auspices of the American Foundrymen's Society. The first appeared in the February issue of American Foundryman.

Information as to practical methods of calculating the solidification times of castings has been long desired by foundrymen. There are many practical applications which could be made, such as calculating riser sizes, establishing shake-out times, etc. It is important, therefore, to review the progress which has been made in this respect, and particularly the contributions of the Analogue approach to the problem.

At the start of the A.F.S. heat transfer work two entirely different procedures for the calculation of relative solidification times were available. The two methods provided completely different answers and it was not known which of the two methods, or if either, was correct. Of the two, the use of solidification formulae of the type $D=K\sqrt{t}-C$ (skin thickness proportional to square root of elapsed time minus a delay constant) was more generally known. These formulae merely represented the rate of growth of the skin developed in bleeding test studies. It was known that the formulae predicted skin growth only to approximately half thickness and that more complex and difficult formulae would be required to predict the last half of the skin growth cycle observed in the bleeding tests. In view of the demonstrated inadequacies of the bleeding test data it may now be concluded that such data of this type as exist in the old literature are of no significance to the calculation of relative solidification times.

The second method which was available is credited to Chvorinov; the method was evolved from theoretical considerations and justified on a basis of thermal analysis check data. Chvorinov's solution was first evolved for semi-infinite plates and expressed as the formula:

$$T=(V/SA)^2/M^2$$

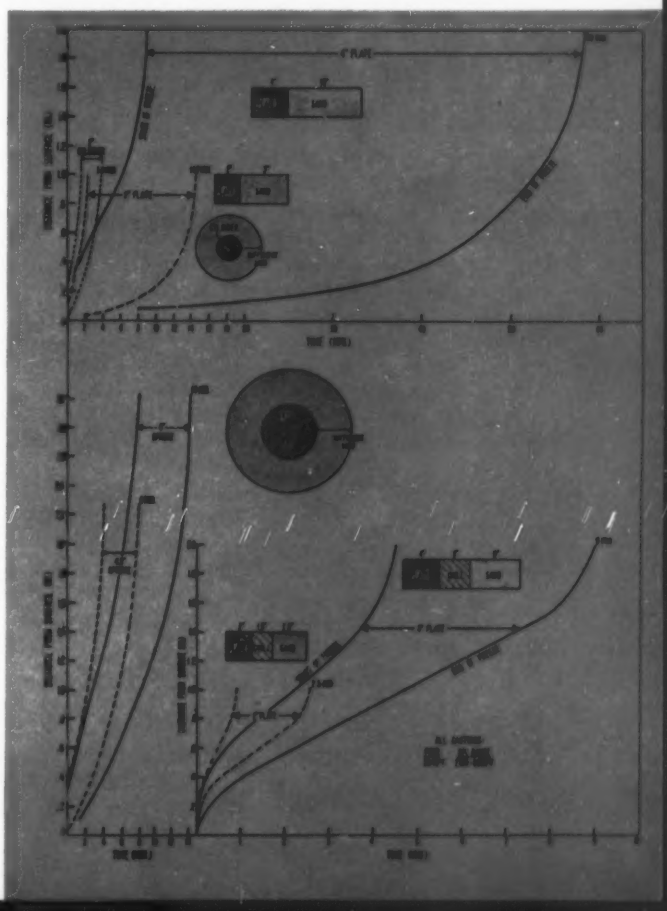
T = freezing time, hours; V = volume; SA = surface area; and M = constant (2.09).

While Chvorinov derived the formula only for the case of semi-infinite, i.e., large plates, it was claimed that the equation is valid for castings of finite size with only small error. It was also claimed by Chvorinov that the relative freezing times of two shapes is predicted by the ratio of the relative $(V/SA)^2$, that is:

$$\frac{\text{Solidification time of Casting A}}{\text{Solidification time of Casting B}}=\frac{(V/SA)^2 \text{ of A}}{(V/SA)^2 \text{ of B}}$$

Clearly, the information provided is of great value if it could be shown to be valid. The Analogue accordingly was directed to resolving this problem. Figure

Fig. 13—Analogue solidification curves for various steel castings illustrate shape, size, and mold effects.



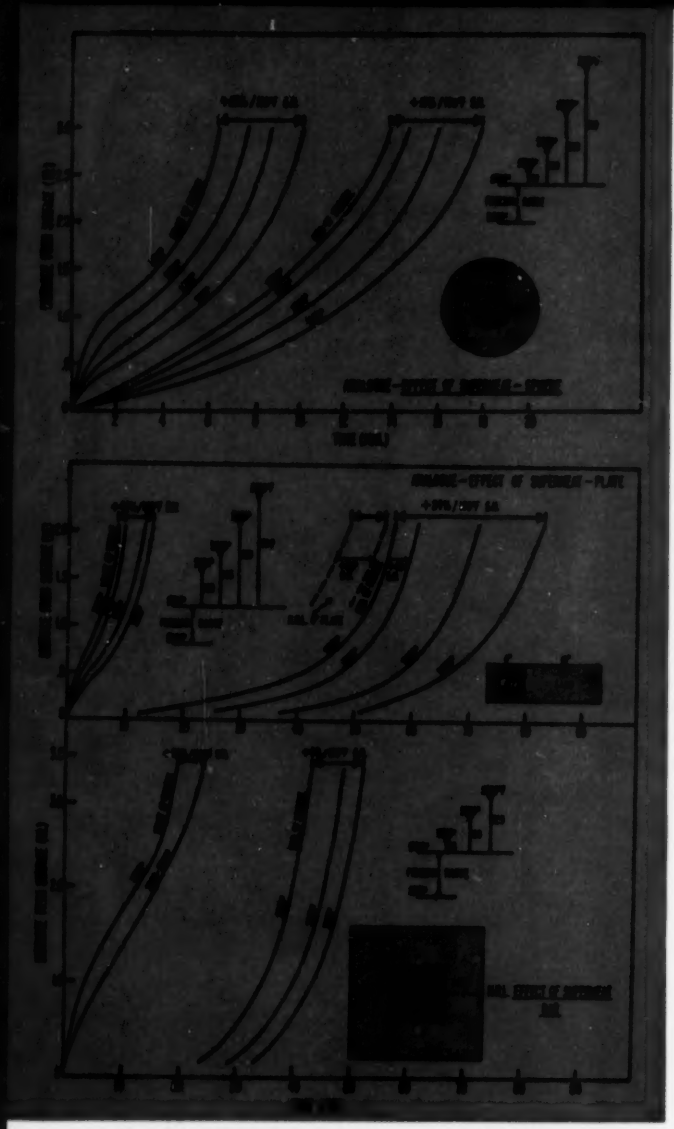


Fig. 14—Analogue and thermal analysis curves show superheat effects for various forms of steel castings.

13 presents Analogue solidification curves for various simple shapes, illustrating the case for sand and chill wall solidification. The same time-distance scale is used for the sand casting while an expanded scale of time is used for the case of the faster solidifying chill casting. These various curves were assembled into one figure to emphasize the effects of shape, thickness of casting and mold material on solidification times.

The effect of shape (surface area to volume ratio) is very great as may be deduced from observation that a 4-in. plate requires 58 minutes to solidify, while a 4.5-in. sphere requires only 8 minutes, i.e., approximately the same time as required for a chilled 4-in. plate. It is also noted that the effects of thickness variations for the same shape are not in direct relation to the thickness but to the square of the thickness dimension as predicted by Chvorinov.

Various calculations are presented in Appendix A to illustrate the reliability of the $(V/SA)^2$ relation, at least for shapes of simple geometry. It may be noted from the variety of calculations which are presented that there is considerable promise to the method; in many cases the calculations are very nearly exact. At our present state of knowledge it is concluded that the freezing times of simple shapes such as plates, cylinders, spheres, etc., may be calculated with a high degree of precision using Chvorinov's formulae.

Get Rough Approximation of Freezing Time

Bars and probably rectangular and cube shapes freeze approximately 10-15 per cent slower than indicated by Chvorinov's formulae. The use of a modified constant (1.92) evolved by the Naval Research Laboratory permits accurate determination of freezing times for these shapes. It should be observed that these relationships hold for normal superheats of 150-200 F. Significant variations outside of these limits result in changes of freezing times in the order of 5-10 per cent (to be described in the sections which follow). Thus, as a generalization it may be stated that the calculations will generally provide answers in the order of $\pm$ 15 per cent of the actual values. For the case of short bars, cylinders or plates (roughly of a length *less than* 4 times the thickness) the calculations are only rough approximations of the actual freezing times.

It should be recognized that for purposes of calculating freezing times for the determination of riser sizes, complex castings require breaking down into the various sections which are fed by specific risers. This process, which has been explained in detail by Caine will be developed to a high degree of exactness once the feeding range and the effect of one section on the solidification of other sections which are joined to it are known accurately. Lately, feeding range data have become available, however, data of inter-effects of sections are still required. The obtaining of such data represents the next logical approach to the problem of complex castings.

In review of the published Analogue research reports concerned with relative freezing times it may be noted that the conclusions of these reports are in direct contradiction to the above interpretive comments regarding the Chvorinov approach. This is due to the incorrect assumptions, at the time, that "start of freeze" rather than the "end of freeze" curves indicated solidification times. Since the $(V/SA)^2$ relationships do not hold for the "start of freeze" curves it was concluded that the Chvorinov relationships were not valid even for simple shapes. With the realization that the "end of freeze" indicated the correct solidification end times the error was rectified and a review of the earlier data indicated the need for the revised conclusions which have been presented in the foregoing sections of this report.

Effect of Metal Variables on Solidification

The effects of superheat level and solidification range have been investigated in detail by the Analogue and checked by thermal analysis experiments. The data which are available present a clear picture of the effects of these variables. Figure 14 presents Analogue solidification curves for 6-in. spheres and 4-in. plates cast with various levels of superheat, and similar Naval Research Laboratory data obtained by thermal analysis of 7 x 7-in. cast steel bars. It is read-

ily apparent from these curves that high superheat causes an initial delay in the progression of the "start of freeze" curves. This represents a delay during the time superheat is being eliminated. Such an occurrence should be expected inasmuch as the mold accepts heat at a given rate and the delivery of superheat should occur at the expense of heat of fusion, thus resulting in a slower rate of formation of solid.

It is indicated also that after superheat is eliminated the "start of freeze" curves become parallel, i.e., solidification proceeds at the same rate regardless of the initial superheat, however, the curves are displaced on the time axis by an amount equal to the total delay occasioned during the loss of superheat. The relative displacement of the "end of freeze" curves is somewhat greater than that of the "start of freeze curves" resulting in broadening out of the solidification band, which signifies that freezing occurs with the formation of a somewhat wider mushy zone. The effect is not pronounced, however. The greater effect on the "end of freeze" curves may be ascribed to the heating of the mold wall which effectively has the same result as a slightly warm mold.

Good Reason to Pour Cold?

There also appears to be a greater effect in displacing the solidification curves in the case of plates as compared to spheres and bars, which indicates that the effect of superheat is somewhat dependent on shape factors. The evidence in this respect is not conclusive, however, it is observed that a "24 per cent delay per 100 F superheat" is developed in the case of the plate while only "10 per cent delay per 100 F superheat" is developed in the case of the sphere and bar castings. If further research should show this to be true there appears to be good reason to pour cold, because shapes of high V/SA ratios (slow freezing shapes) such as the cylindrical shapes used for risers develop less delay than rangy shapes such as plates. Obviously, a riser system which is barely adequate for a rangy casting at low pouring temperatures would revert to being inadequate at higher pouring temperatures. More research on this particular question appears to be highly desirable in view of its practical significance.

The effects of solidification range are illustrated in Fig. 15. It is apparent that the Analogue and thermal analysis methods are in agreement that narrower freezing ranges result in more progressive freezing. This signifies that the mushy zone developed during freezing is narrower, hence conducive to easier feeding. This fact has been checked experimentally and it was shown that 0.10% C steel which has a very narrow freezing band will feed to soundness for much longer distances in flat plates than 0.30% and 0.50% C steels which have broad freezing band characteristics. It may be observed also that the Analogue and thermal analysis predictions, while in the same direction, apparently disagree as to the degree of the effect. The disagreement may not be real, however, since the V/SA ratios of the two castings used are quite different (plate vs. bar). This represents another case of information which is required regarding shape factors.

The effect of the conductivity of the solidifying metal on the end of freeze curves was also investigated by the Analogue. It was found that changing the conductivity by as much as ± 20 per cent of the values determined for steel had no significant effect on the final solidification time. This is not surprising inasmuch as the conductivity of the steel is very much greater than the conductivity of the sand; accordingly the factor which limits heat flow is the sand itself.

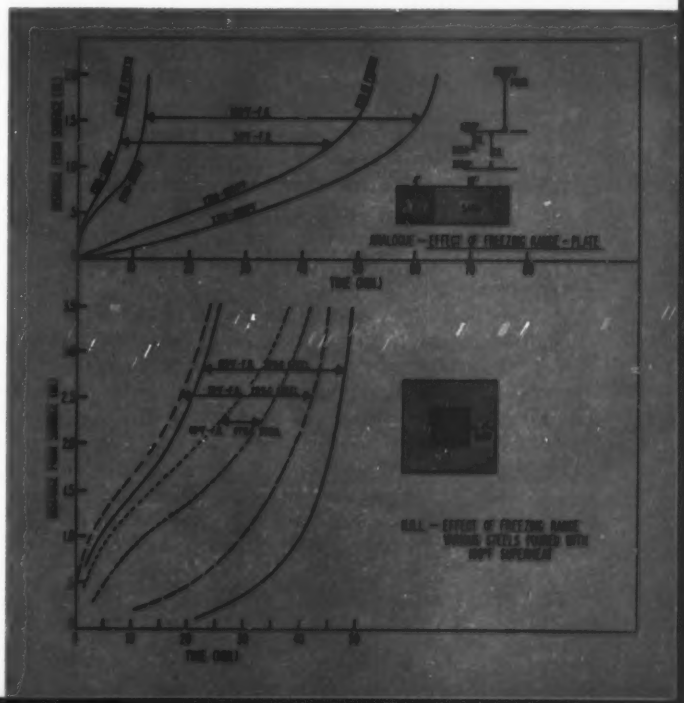
Conductivity of Metal Not Big Factor

A water analogy may be made to this problem. If the rate of heat flow from the casting into the sand is represented by the rate of water flow through a small diameter pipe, it will be apparent that changing the size of the already larger pipe which exists in the casting (higher conductivity through the casting) will have no effect on rate of heat passage (water flow) into the sand. Accordingly, solidification times should remain unchanged.

This statement holds only for the case of sand molds. In the case of chills the conductivity is essentially similar to that of the solidifying metal, hence it should be expected to have a great effect on solidification rates. Analogue studies related to the effect of conductivity for chill walls have not been carried out, however, thermal analysis studies have indicated that such is the case.

The effects of specific heat and heat of fusion were also investigated. As should be expected, increasing the total amount of heat which must be removed during solidification has a pronounced effect on final solidification time. Increasing heat of fusion by 10 per cent increased solidification time by approximately the same percentage. Increasing specific heat by 10 per cent had a considerably smaller effect. A consideration of the relative fraction of the total heat which must be removed during solidification, indicates that 10 per cent increase in specific heat means the addition of considerably less extra heat than a 10 per cent increase in heat of fusion. Obviously, the effect on solidification

Fig. 15—Analogue and thermal analysis curves illustrate freezing range effects for steel bars and plates.



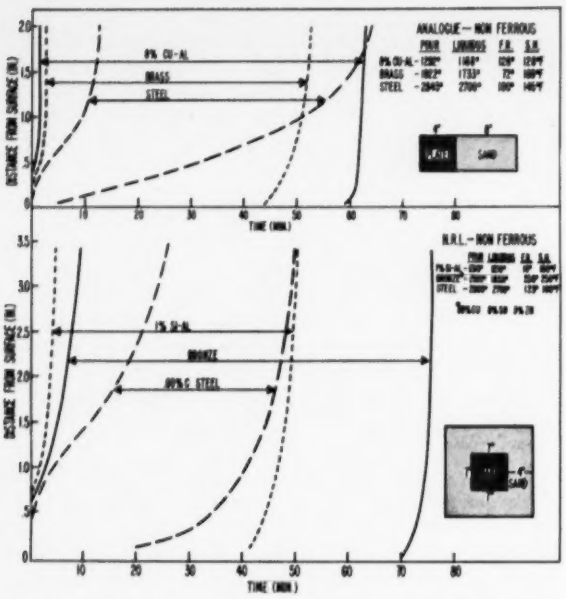


Fig. 16—Solidification curves determined by Analogue and thermal analysis for non-ferrous metals compared with steel. High conductivity non-ferrous alloys show "broad band" freezing of entire casting section.

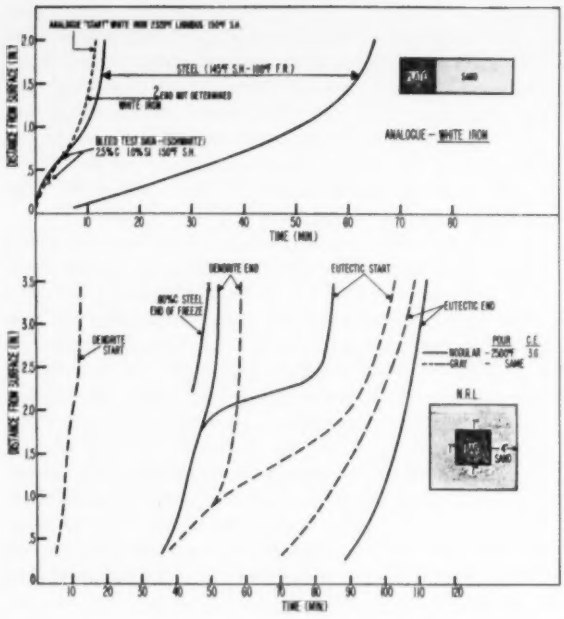


Fig. 17—Separate dendrite and eutectic freezing waves move across castings. Analogue "start of freeze" and bleed test data for white iron are compared with steel "start of freeze." Thermal analysis solidification curves for gray and nodular irons compared with "end of freeze" (eutectic end) for 0.60%C steel show that solidification of irons is much slower.

time should be in near proportion to the extra heat added or subtracted.

Studies of metals other than steels by the Analogue have been of relatively limited nature to date. Figure 16 presents Analogue data and comparative thermal analysis data for aluminum and copper alloys. The solidification curves of these alloys are compared also with curves determined for steel. It is apparent the two methods are in agreement in denoting that the solidification of these very high conductivity alloys is characteristically different from the solidification of steel which has lower conductivity.

While the steel develops a completely solid skin at intermediate solidification times, the non-ferrous alloys do not do so until very late stages of solidification. As the result, the subject non-ferrous castings becomes completely mushy from surface to center during a period which may be as long as 90 per cent of the total solidification time. Solidification during this time proceeds by gradual thickening of the solid dendrites throughout the casting until very little liquid remains. When the final freezing wave moves through the casting there is very little liquid left to solidify and as the result the "end of freeze" wave proceeds at very high rates as denoted by the steepness of the final solidification line.

The difficulty of feeding the tortuous, interdendritic channels existing throughout the casting from surface to center under conditions of very rapid final freezing accounts in part for the interdentric shrinkage and leakage channels which are typical of such alloys. The tendency of such alloys to "puncture through" from the skin when a gross shrink area is formed is also related to the lack of a completely solid skin at intermediate stages of solidification.

The development of general freezing throughout the casting despite narrow solidification ranges (10 F freezing range for 1 per cent Si-Al alloy for example) may be ascribed to the extremely high conductivity of these alloys. Effectively, only the very slightest thermal gradients can be developed across a solidifying casting, since heat flow can occur from the center outward with great rapidity (Fig. 9). Thus, the temperature near the surface can never be much lower than the center temperature, with the result that the solidification conditions which exist near the surface must necessarily be only slightly in advance of the solidification conditions which exist at the center.

It is only with freezing ranges of essentially nil values (very high purity aluminum or copper) that such metals may be made to freeze progressively in sand molds. The only alternative for high conductivity alloys having an appreciable freezing range is to use mold walls of very high conductivities, i.e., to remove heat faster than can be moved across the solidifying casting. For aluminum and copper alloys this obviously is not practical, although thin, water-cooled mold walls may satisfy the requirements.

It is observed from Fig. 16 that the solidification times of the non-ferrous alloys are in the order of the solidification of steel and longer. Two factors related to the rate of heat removal by the sand act to prolong the solidification time: (1) the lower interface temperature and (2) the lower conductivity of the sand at the lower temperature. The latter effect was clearly shown by the Analogue in an attempt to check Hunsicker's bleeding tests of aluminum. The first Analogue tests were made using the same sand conductivity

which was used for steel, from which it was determined that the "start of freeze" curve traced an earlier path than the skin thickness curve developed by the bleeding tests. On reconsideration it was decided that an error had been made in that the lower conductivity of sand at aluminum solidification temperature should have been used. When this was done an excellent check was obtained.

Investigation of the solidification characteristics of irons by the Analogue were performed only for the case of white iron of malleable grade (Fig. 17). In this case only the "start of freeze" curve was obtained and found to provide a good check at early stages with the skin growth observed for bleeding tests by Schwartz. Figure 17 also presents comparative solidification curves for steel to illustrate that the rates of initial freezing are quite similar. Inasmuch as the initial mode of freezing represents austenite dendrite formation in both cases this is not unexpected.

Thermal analysis studies have indicated that the mechanism of solidification following the initial start of dendrite formation is considerably more complex than for steel (Fig. 17). It is observed that the solidification curves indicate the movement of several freezing waves across the casting section as demanded by the phase diagram of the complex iron alloys. It is also observed that the final solidification times of gray and nodular iron occur at considerably later times than the solidification of steels—at least twice as long is required for complete solidification than for a 0.60% C steel. Several factors probably account for this behaviour: (1) lower solidification temperature; (2) much wider solidification ranges necessitating the removal of extra amounts of specific heat of solid during solidification; (3) lower conductivity of the metal as the result of graphite formation.

It is apparent from the questions which have arisen concerning plain carbon steels, and the relatively sketchy information which exists relative to other metals, that a considerable amount of research remains to be performed. The methods to be used are now well defined and the interpretations which may be made are fairly well establisehd. Ultimately a collection of solidification curves will become available to match the valuable S curves, which also have required years to gather and for which the process continues.

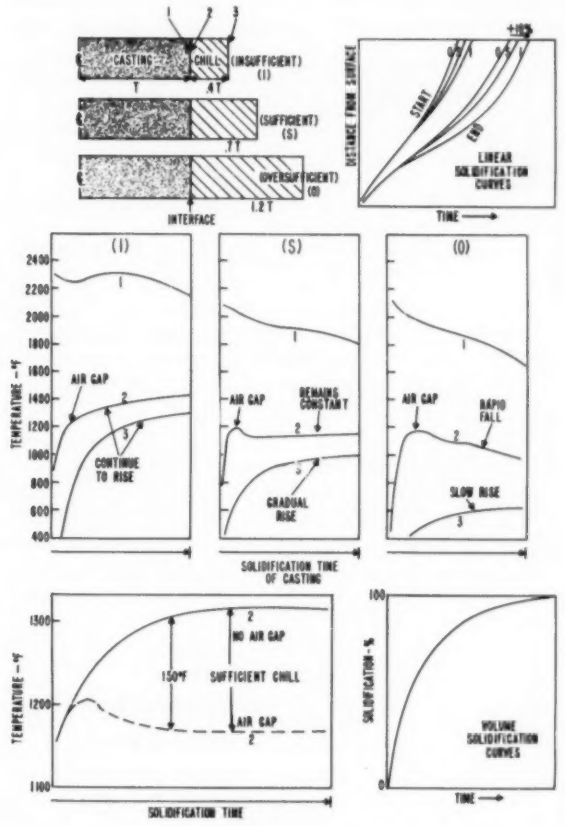


Fig. 18—How chill thickness affects solidification rates of steel. Effects are related to heat capacities of chills; air gap decreases rate of heat transfer.

Mold Variables

The temperature conditions in the mold, insofar as the solidification of the casting is affected thereby, are of considerable interest to foundrymen. It was shown in the previous sections that the rate of heat extraction by the mold when varied over wide limits, such as sand to chill, not only affects the rate of solidification but also the nature of solidification itself. It is the purpose of the discussions which follow to consider the question of variations in mold conditions in greater detail. The

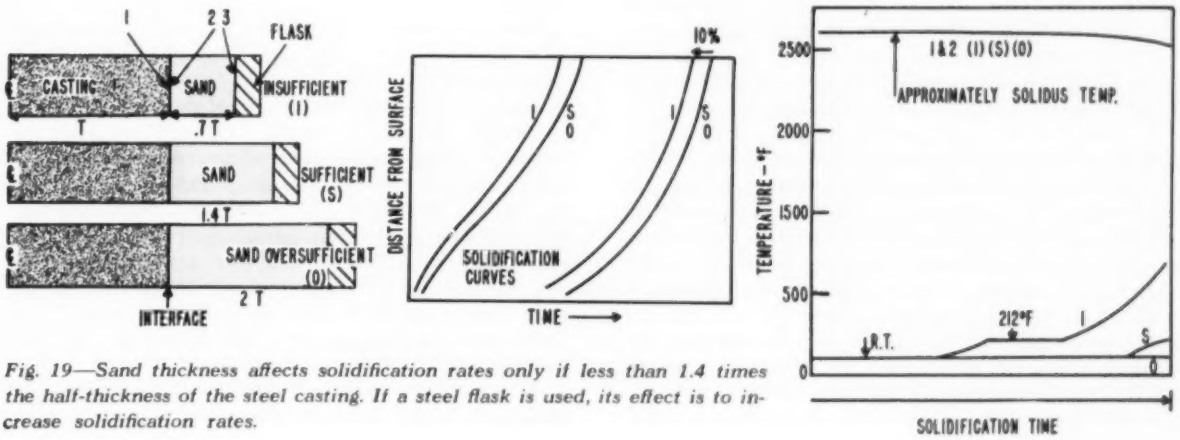


Fig. 19—Sand thickness affects solidification rates only if less than 1.4 times the half-thickness of the steel casting. If a steel flask is used, its effect is to increase solidification rates.

effects on the solidification of the metal, as well as the reasons for such, will be considered inasmuch as an understanding of the heat transfer conditions in the mold provides the information required to effect practical control over the solidification of castings.

When Mold Is Saturated With Heat

At the start of the A.F.S. heat transfer studies it was known that the temperature gradients in the sand adjacent to the casting were relatively steep in comparison to chill gradients; also, that the interface temperature of the sand approached the temperature of the solidifying metal. Quantitative data as to the effect of variations in the properties of the sand, thickness of mold, dry vs. green sand, chill thickness and other such practical variables were not available. Following the exploratory work which provided quantitative data as to the solidification of metals under one specific condition of sand properties (dry sand of fixed conductivity), the Analogue investigations were directed to similar exploratory work related to mold variables. At the same time thermal analysis data became available which served as a check on the Analogue data as well as providing related information.

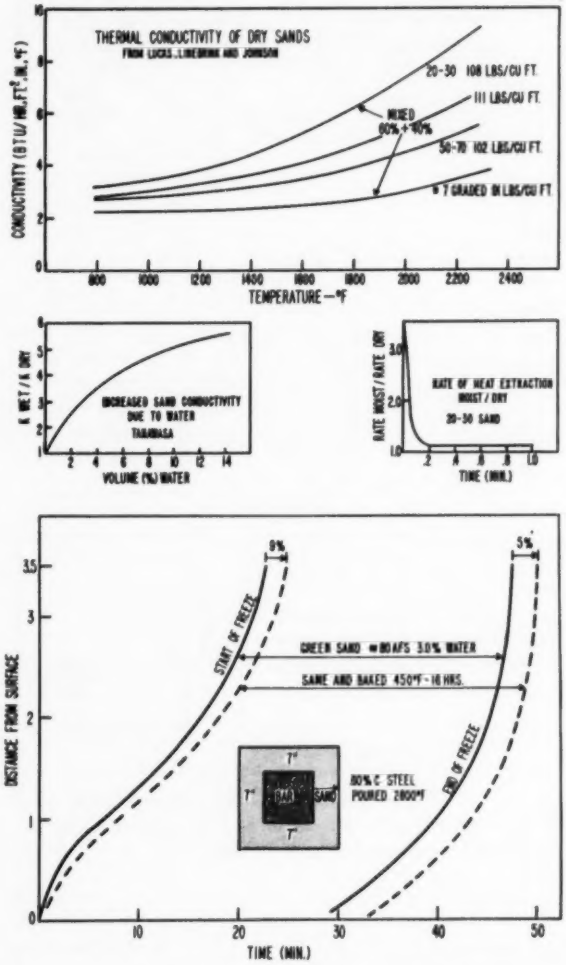
It should be recalled that the mold thickness conditions assumed for the previously discussed Analogue and thermal analysis studies related to "sufficient mold walls." The significance of this concept requires discussion. In simple terms this means that the mold walls were assumed to be of sufficient thickness to prevent a significant rise in temperature at the flask during the course of the solidification of the casting. In extreme cases the rise in temperature may be sufficient to approach heat saturation. With the approach of saturation the mold is no longer able to absorb heat (specific heat capacity is used up) and while it can continue to pass heat to the exterior, the rate of heat transfer may be decreased (chill) or increased (sand) as will be explained in the following sections.

Effect of Chill Size

Figure 18 illustrates the case of chill sufficiency for a bar casting (steel) completely surrounded by chills of thickness *equal to, less than,* and *greater than* sufficiency. It is observed from the temperature gradients at the chill interface and chill outer surface that the insufficient chill (0.4 of the casting thickness —0.4T) becomes saturated with heat early during the solidification period and that its temperature continues to rise during solidification. Also, that the temperature difference between interface and surface is small (approx. 150 F) indicating relatively slow passage of heat. If the chill were made much smaller, say 0.1T, the chill temperature would approach the casting temperature at early times and such a chill would act as if it were an extension of the casting—i.e., it would pass but not absorb heat. The effect of such a thin chill would be felt only during the very first period of solidification. For purposes of countering a hot spot without "freezing off" the section it is necessary to use thin chills which have such a short time action.

It is observed that the sufficient 0.7T chill develops a nearly constant temperature at its interface during solidification and that the surface temperature continues to rise. Such a chill strikes a heat transfer balance with the casting, passing heat at about the same rate it is received from the casting. The oversufficient 1.2T chill develops a falling temperature after the initial rapid heat transfer is decreased. Heavier chills behave in a similar but more drastic fashion.

In order to understand the described behaviour it is necessary to consider the fact that volume rates of solidification (lower left, Fig. 18) constantly decrease with time, in contradistinction to the increasing rate shown by the previously discussed linear solidification curves. Since a greater total amount of metal is solidified during early times there is a greater heat load to be transferred at early times, hence the natural tendency for the heavy chill to cool-off during later stages of solidification.



There is moreover another effect, i.e., the formation of an air gap at the casting-chill interface due to shrinkage of the solid portions of the solidifying casting. From Analogue and related studies by Paschkis it is concluded that the exact width of the air gap is not important, at least for the high melting point metals, since heat is *radiated* across the chill-casting gap. The formation of an air gap is demonstrated by the Analogue and thermal analysis to decrease the rate of heat flow which prevails during the "contact" period, i.e., during the time that the intimate contact of casting

and chill permits direct heat transfer by conduction. The rate of solidification is decreased as the result. There are conditions, however, such that an air gap cannot form (for example casting located over the chill) under such conditions the chill interface reaches a higher temperature (lower left, Fig. 18).

The effect of chill sufficiency is indicated by the solidification curves. Within the limits of chill thickness represented (1.2T to 0.4T), an increase of 10 per cent in solidification time is noted for the insufficient chill. It is also observed that at early times of solidification the metal does not know whether it is against a 0.4T or 1.2T chill. This should be expected, inasmuch as the chills did not have time to heat through, hence all act as very thick chills at early times.

The effects of sand thickness, if a steel flask is used, are the reverse of that observed for the chill, as shown by Fig. 19. It is observed that the casting-sand interface essentially holds a fixed temperature (very close to solidus temperature) during solidification, irrespective of the sand thickness. The temperature of the sand at the flask interface is raised considerably if the mold wall is less than approximately 1.4T, resulting in a more rapid transfer of heat than in the case of sufficient or over sufficient sand walls. The reason for this may be found in the fact that the sand is heated through and therefore becomes a better heat conductor. It has been shown that the conductivity of sand increases with temperature since most of the heat transfer is by radiation from grain to grain—the higher the temperature the greater the transfer of radiant heat.

This fact also explains why the formation of an air gap (if such occurs has not been established) at the sand interface should not be expected to result in a significant difference in the rate of heat passage from casting to sand. At least,the temperature records at the interface show no sign of an air gap "hump" observed in the case of chills. The action of the flask in entering into heat extraction from the casting results in faster solidification. With the conditions shown, a 10 per cent decrease in solidification time was observed. It should be noted that unlike the case for the chill there is no effect in increasing the sand thickness above the point of sufficiency.

The action of the flask indicates that metal mold inserts may act as indirect chills even when located considerable distances from the mold cavity. Care should therefore be exercised in placing rods, etc., particularly near risers. The practice of placing risers near flask corners with a small thickness of sand separating the riser from the flask obviously will result in defeating the riser by virtue of a decreasing its solidification time.

The problem of thermal property variations of common foundry sands is difficult to analyze inasmuch as the properties are highly temperature sensitive. Despite the complexity of the problem the Analogue has provided answers which are of considerable practical interest. Before the problem could be studied it was necessary to obtain data regarding the specific conductivities of various sands over the entire temperature range of 75 F to metal solidus temperatures. Conductivity data for dry sands were obtained by Lucks; the effect of moisture on conductivity was determined from data reported by Tanawasa. Figure 20 summarizes the various data; it may be observed that the conductivity of sands increases markedly with temperature in the range of 1000-2300 F and that increasing grain size results in a more rapid increase of conductivity with temperature. This effect is due to the previously described condition of heat transfer by radiation from grain to grain. Filling of the intergrain spaces with fines results in decreased conductivity since the effective path for radiation is diminished.

The effect of moisture content on the "apparent" conductivity is very great as may be deduced from Tanawasa's data. Common moisture contents of 4 per cent increase the effective conductivity approximately 3½ times. These last data are somewhat misleading, however, for as shown by the Analogue the effect of high conductivity due to the presence of water is momentary and moreover represents an "effective" or apparent increase rather than true change in thermal conductivity properties. Figure 20 illustrates Analogue data which indicates that the several-fold rate of heat ex-

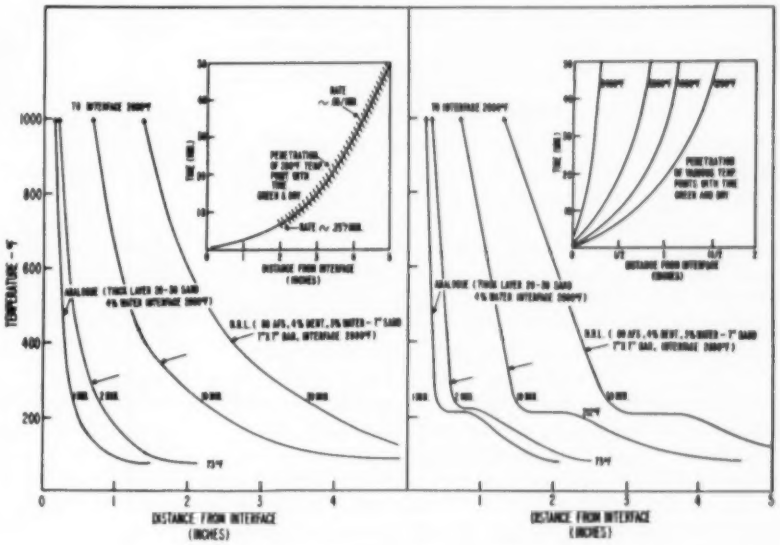


Fig. 20—Graphs (upper left) show how thermal conductivity of sands increases with temperature. Momentary high conductivity when metal first contacts green sand is lost as sand dries, assumes normal conductivity.

Fig. 21—Thermal analysis curves (lower left) indicate small increase in solidification rate of thick castings due to moist sand. For thin-walled castings (probably less than ½ in.) effect should be greater.

Fig. 22—Heat penetration (right) into green and dry sands are relatively minor as shown by scatter band region. Rise of temperature was measured at various positions in mold.

traction is developed only during the period (approximately 1 second) that the moist sand at the interface is dried. During this period the water is changed to steam and the extra heat is removed by convection of steam through the air spaces of the mold. As soon as this process is completed the interface is occupied by dry sand and thereafter the controlling effect is primarily that of the dry sand conductivity of this initially thin layer. On this basis the Analogue predicts that the solidification times of large castings should be relatively unaffected by water content of the sand. Thin castings, however, should be greatly influenced by the presence of water.

Figure 21 presents thermal analysis data for a heavy section which indicate approximately a 5 per cent decrease in solidification time due to the presence of water. This is in agreement with the Analogue predictions. It is believed that the continuing slight effect of water following the formation of the initial dry layer, is due to the continuing extraction of added heat in the sand layer which is at steam temperatures. The effect may be visualized as being somewhat similar to the presence of a mild chill which moves outward in the mold with the movement of the 212 F zone.

Dry and Green Sand Effects

Figure 22 illustrates the temperature conditions which exist in dry and green sand molds at various times during solidification as indicated by the Analogue and by thermal analysis. The Analogue studies were limited to very short times since the primary interest was the effect of initial drying of the sand at the interface. It is noted that the Analogue correctly indicates the gradient conditions observed by thermal analysis at very early times. The thermal analysis curves for later times indicate clearly the "steam hold" or isothermal zone which represents the region of steam formation in the case of green sand. The main difference in the thermal gradient curves for green and dry sand concerns the nature of the gradients at temperatures near 212 F. Since the 212 F steam hold is not developed in the case of the dry sand the thermal gradient conditions extend a somewhat greater distance into the mold. This indicates that the depths of heating of a dry sand mold are always somewhat greater than for a green sand mold, the differences are quite small, however.

Figure 22 presents data indicating the rates of penetration of various temperature points into the sand mold wall. The rate of penetration of the 200 F temperature point is relatively rapid compared to that of the higher temperatures. At the end of 50 minutes (approximate solidification time for a 7 x 7-in. bar of steel) the 200 F point has penetrated to approximately 5 inches while the 2000 F point has penetrated only to approximately ¾-in. These data are of interest in indicating the complexity of the problem concerning sand properties (hot strength, plasticity, etc.).

Obviously a steep gradient of sand properties must exist to match the steep thermal gradients observed. The steepness of the thermal gradients and the slow nature of heat penetration depicted by these curves illustrate the poor thermal conductivity of sand. It is significant that the effects of sand (variations in thickness of mold wall for example) are best visualized by considered the sand as having the characteristics of an insulating material rather than a conducting material.

Actual differences in thermal conductivity of the sand, as contrasted to the apparent differences due to the short lived steam formation at the interface layer, have a considerable effect on solidification rates. Analogue data for the solidification of a 4-in. steel slab with the sand properties varied to conform to the relative conductivities of the sands used by Lucks are presented in Fig. 23. The conductivity values were taken to represent an average conductivity of the overall gradient zone for ease of study. The effect of conductivity on "start of freeze" time is observed to be rather small, however, for the "end of freeze" time the effect is quite pronounced. It is indicated that decreas-

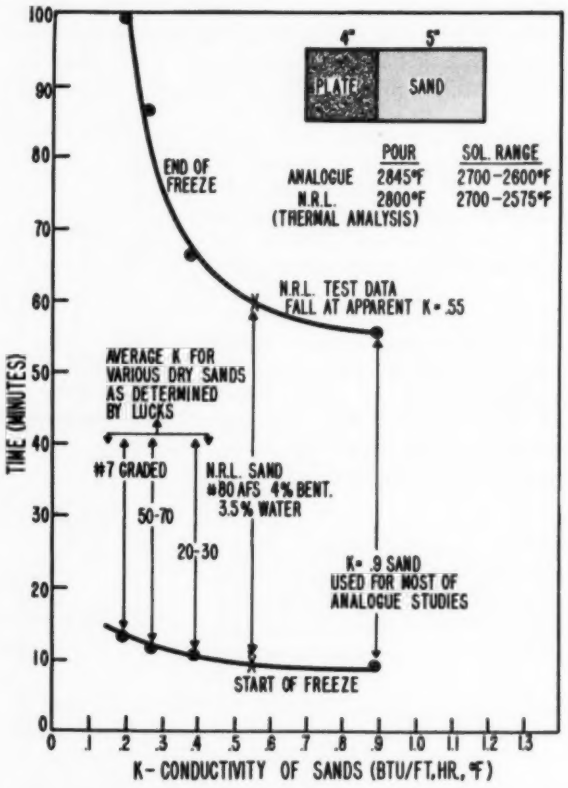


Fig. 23—Analogue "start" and "end of freeze" times for sands for various thermal conductivities.

ing the conductivity by one half (0.4 to 0.2) results in an increase in solidification time of approximately 50 per cent. This surprisingly large effect due to variations of practical sands requires confirmation before acceptance.

Thermal analysis data for the solidification of a 4-in. steel slab in green sand indicate an effective K value of 0.55 when plotted on the curve of Analogue relationships for solidification time and conductivity. It is indicated that the 0.9 K value used for all of the previously discussed Analogue investigations represent a good approximation of the effective conductivity of the gradient zone.

The Analogue investigations for the 1952-1953 period entail an evaluation of the effects of casting edges

or "ends" on the solidification of a simple cylindrical shape, varying in length from 1T (length equal to diameter) to 7T. This investigation may be recognized as a first approach to the problem of the solidification of complex shapes, i.e., castings having longitudinal as well as lateral heat flow patterns. Such a methodical step by step approach is required to obtain fundamental answers to the most important of the remaining problems concerning the solidification of castings.

More Complex Heat Flow

While there is no question as to the importance of this phase of investigation, certain practical aspects related to the complexities of the Analogue problem indicate that this approach should be reconsidered for future planning purposes. The difficulties mentioned relate to the fact that two-directional heat flow requires the use of complicated Electrical Analogue wiring systems, inasmuch as a double system of casting "lumps" must be used. Therefore, it is indicated that such studies may perhaps be conducted to best advantage by using thermal analysis methods, particularly if several shapes are to be considered. This follows from the fact that a new wiring "set up" must be made for each new shape while studies related to metal or mold variables of a single shape may be made simply by varying the capacitance and resistivity of the various electrical components—an easier and considerably less expensive change.

In essence this means that property changes and simple shape changes may be made and studies conducted at a lesser cost than for thermal analysis methods. The cost of a single thermal analysis study is fixed and does not decrease with number of studies, this is not true for Analogue studies for the initial cost of the wiring "set up" is a major item, particularly if the "set up" is complex. This discussion serves to indicate the apparent fields of casting solidification and related studies which are best handled by thermal analysis and by Electrical Analogue methods. Such practical considerations must necessarily serve as guides for the planning of future investigations.

Plan Future Work

A considerable number of important investigations concerned with single direction heat flow (semi-infinite shapes), such as described in the body of this report, remain for future work; several of these have been indicated previously. For purposes of summarization these may be grouped as follows:

1. Metal Variables: Studies concerned with the solidification features of various practical metals. The limitations of this approach involve the availability of proper thermal constants for the various metals.

2. Shape Factor Variables: Studies concerned with the effects of shape on solidification time, i.e., such as the effect of superheat, etc., on the solidification time of "rangy" and "chunky" shapes.

3. Mold Factor Variables: Studies concerned with heat flow rates in sands. Such studies could relate not only to the effects on the solidification of the metal but also on the sand itself. For example: (a) Thermal gradients developed in cope surfaces due to radiant heating which could result in cope spalling, also in drag surfaces from the initial spreading out of the liquid metal which could result in buckling; (b) Temperature losses in flowing through gating systems, and the possibility of solid skin envelope formation in sprues and runners; (c) Rates of heating of cores completely surrounded by metal; (d) Effects of combustibles (oil, sea coal, etc.) on sand thermal gradients and heat extraction rates, etc.

It is obvious that the problem of future planning is concerned not so much with the limitations of the Electrical Analogue as with the choice of the most important of the many investigations which could be made. It is requested therefore that A.F.S. members express their interest in the various possible types of investigations (not necessarily included in the above) by informing the Heat Transfer Committee of their considered opinion as to the information which is most urgently required. The consensus should serve as a guide in planning future programs.

Appendix

Method of calculating freezing times of simple shapes based on Volume to Surface Area relationships.

(A) V/SA relationships for various shapes (D = diameter or thickness).

Shape	V	S	V/SA
Sphere	$\pi D^3/6$	πD^2	D/6
Long Cylinder	$\pi D^2 L/4$	πDL	D/4
Large Plate	DLW	2LW	D/2
Cube	D^3	$6D^2$	D/6
Long Bar	D^3	$4D^2$	D/4

(B) Direct Calculation method (Chvorinov); constant applies only to steel castings.

$$\text{Freezing time (min)} = \frac{(V/SA)^2}{(2.09)^2} \times 60$$

Example: F.T. of 4-in. Plate

$$\text{F.T.} = \frac{(V/SA)^2}{(2.09)^2} = \frac{(D/2)^2}{(2.09)^2} = \frac{(4/2)^2}{(2.09)^2} = \frac{4}{4.38} \times 60 = 55 \text{ min.}$$

Example: F.T. of 6-in. Sphere

$$\text{F.T.} = \frac{(D/6)^2}{(2.09)^2} = \frac{1}{4.38} \times 60 = 14 \text{ min.}$$

Example: F.T. of 6 x 6-in. Bar

$$\text{F.T.} = \frac{(D/4)^2}{(2.09)^2} = \frac{(6/4)^2}{4.38} \times 60 = 30.8 \text{ min.}$$

It was determined as the result of NRL thermal analysis investigations that Chvorinov's constant (2.09) of formula *B* while apparently correct for plates, spheres and cylinders should be modified to (1.92) for bars. Recalculation of the above example using the 1.92 constant yields exact check with the observed solidification times of bars.

$$\text{F.T.} = \frac{(D/4)^2}{(1.92)^2} = \frac{(6/4)^2}{3.7} \times 60 = 36.5 \text{ min.}$$

For purposes of this appendix the modified Chvorinov formula will be termed formula *D*.

(C) Relative calculation method (Chvorinov). If the F.T. of one shape is known, the F.T. of other shapes may be determined as follows:

$$\frac{\text{F.T. of Shape A}}{\text{F.T. of Shape B}} = \frac{(V/SA)^2 \text{ of A}}{(V/SA)^2 \text{ of B}}$$

Example: F.T. of 4-in. steel Plate is known to be

55; use to calculate F.T. of 6-in. steel Sphere.

$$\frac{\text{F.T. Sphere}}{55}=\frac{(D/6)^2}{(D/2)^2}=\frac{(6/6)^2}{(4/2)^2}=\frac{1}{4}$$

$$\text{F.T. Sphere}=\frac{(1)\ (55)}{4}=14 \text{ min.}$$

Example: Calculate F.T. of 7 x 7-in. steel Bar from F.T. of 4-in. Plate.

$$\frac{\text{F.T. Bar}}{55}=\frac{(D/4)^2}{(D/2)^2}=\frac{(7/4)^2}{(4/2)^2}=\frac{3.05}{4}$$

$$\text{F.T. Bar}=\frac{(3.05)\ (55)}{4}=42 \text{ min.}$$

This formula may be used to calculate F.T. of any metal if the F.T. of one simple shape is known. For example the F.T. of 7 x 7-in. bronze Bar cast in sand is 75 min.; calculate F.T. of 2-in. bronze Plate.

$$\frac{\text{F.T. Plate}}{75}=\frac{(D/2)^2}{(D/4)^2}=\frac{(2/2)^2}{(7/4)^2}=\frac{1}{3.05}$$

$$\text{F.T. Plate}=\frac{(1)\ (75)}{3.05}=25 \text{ min.}$$

FREEZING TIME CALCULATIONS COMPARED TO ANALOGUE FREEZING TIMES

Analogue	Freezing Range	Super-heat	Casting	Analogue Freezing Time	Calc. R.F.T. Formula C
Steel, .60%C Dry Sand K = 0.9	2700-2600F	145F	2-in. Plate	14.2 min.	14.2 Basis*
K = 0.9	2700-2600F	145F	4-in. Plate	58	58
K = 0.9	2700-2600F	145F	2-in. Cyl.	3.8	3.6
K = 0.9	2700-2600F	145F	6-in. Sphere	14	14.2
K = 0.9	2700-2600F	145F	4½-in. Sphere	8	8
Chill	2700-2600F	145F	2-in. Plate	2.5	2.5 Basis for R.F.T. calc. below
Chill	2700-2600F	145F	4-in. Plate	9	9

*That is, F.T. of 2-in. Plate used as basis for calculation of the R.F.T. of the remaining castings.

Example for case of chill. Figure 13 shows F.T. of 4-in. Plate cast with chill walls is 9 min.; calculate F.T. of 2-in. Plate cast with chill walls.

$$\frac{\text{F.T. Plate}}{9}=\frac{(D/2)^2}{(D/2)^2}=\frac{(2/2)^2}{(4/2)^2}=\frac{1}{4}$$

$$\text{F.T. Plate}=\frac{(1)\ (9)}{4}=2.3 \text{ min.}$$

The tables in this Appendix present Analogue and thermal analysis data for the solidification times of various shapes (all steel) and the results of calculations. The accuracy of the calculation methods may be evaluated from these comparison data.

References

1. V. Paschkis, H. D. Baker, "A Method for Determining Unsteady State Heat Transfer by Means of Electrical Analogy," *Trans. A.S.M.E.*, vol. 64, p.105 (1942).
2. V. Paschkis, "Heat Flow Problems in Foundry Work," *A.F.A. Transactions*, vol. 52, pp.649-670 (1944).
3. H. A. Schwartz, "Solidification of Metals," *A.F.A. Trans.*, vol. 53, pp.1-35 (1945).
4. K. L. Clark, "Methods Employed to Obtain Rates of Solidification," *A.F.A. Trans.*, vol. 53, pp.88-89 (1945).
5. V. Paschkis, "Studies on Solidification of Castings," *A.F.S. Trans.*, vol. 53, pp.90-101 (1945).
6. H. A. Schwartz, "The Influence of Radiation Within Molding Sand on the Freezing Rate of Metal," *A.F.S. Trans.*, vol. 53, pp.159-162 (1945).
7. V. Paschkis, "Studies on Solidification of Castings," *A.F.S. Trans.*, vol. 55, pp.74-76 (1947).
8. V. Paschkis, "Influence of Properties on Solidification of Metals," *A.F.A. Trans.*, vol. 55, pp.54-61 (1947).
9. C. F. Lucks, O. L. Linebrink, K. L. Johnson, "Thermal Conductivities of Three Sands," *A.F.A. Trans*, vol. 55, pp.62-65 (1947).
10. H. A. Schwartz, "Freezing Rate of White Cast Iron in Dry Sand Molds," *A.F.A. Transactions*, vol. 55, pp.66-68 (1947).
11. H. Y. Hunsicker, "Solidification Rates of Aluminum in Dry Sand Molds," *A.F.A. Transactions*, vol. 55, pp.68-76 (1947).
12. V. Paschkis, "Theoretical Thermal Studies of Steel Ingot Solidification," *A.S.M. Trans.*, vol. 38, pp.117-147 (1947).
13. C. F. Lucks, O. L. Linebrink, K. L. Johnson, "Thermal

EVALUATION OF FREEZING TIME CALCULATION IN COMPARISON TO NRL THERMAL ANALYSIS FREEZING TIME

Data	Steel	Pouring Temp.	Super-heat	Casting	Actual Freezing Time, Min.	Calculated F.T. Formula B		Calculated R.F.T. Formula C	
NRL	.20%C	2950F	170F	2-in. Plate	13.7	13.7		13.5 basis for R.F.T. calc. below	
NRL	.20%C	2950F	170F	2-in. Plate	13.5				
NRL	.20%C	2950F	170F	2-in. Plate	13.5				
NRL	.35%C	2950F	190F	2-in. Plate	14.0				
NRL	.25%C	2900F	130F	4-in. Plate	50	55		54 (min)	
NRL	.25%C	2900F	130F	4-in. Plate	50				
NRL	.25%C	2950F	180F	4-in. Plate	55				
NRL	.60%C	2800F	100F	4-in. Plate	61				
Analogue	2700-2600F Freezing Range (.60%C)	2845F	145F	4-in. Plate	58				
						B	D		
NRL	.30%C	2950F	180F	4x4-in. Bar	16	13.7	16.2	13.5	16.0 basis for R.F.T. calc. below
	.30%C	2950F	180F	4x4-in. Bar	17				
	.30%C	2950F	180F	4x4-in. Bar	17				
NRL	.30%C	2950F	180F	6x6-in. Bar	38	30.8	36.5	30.4	36.0
	.30%C	2950F	180F	6x6-in. Bar	37				
NRL	.30%C	2950F	180F	8x8-in. Bar	66	54.6	65	54	64.0
	.30%C	2950F	180F	8x8-in. Bar	68				

Actual Freezing Time—as determined by thermal analysis of green sand castings (No. 80 AFS Sand).
Formulae B and C as described in text (Chvorinov's).
Formula D as described in text (Pellini-Bishop).

Conductivity of a Sand Mixture," *A.F.S. Trans.*, vol. 56, pp.363-366 (1948).

14. V. Paschkis, "Studies on the Solidification of Aluminum Castings," *A.F.S. Trans.*, vol. 56, pp.366-371 (1948).

15. V. Paschkis, "Studies of Solidification of White Iron Castings," *A.F.S. Trans.*, vol. 56, pp.371-373 (1948).

16. V. Paschkis, "Study on Solidification of Steel Spheres," *A.F.S. Trans.*, vol. 56, pp.373-381 (1948).

17. V. Paschkis, "Comparative Solidification Studies," *A.F.S. Trans.*, vol. 57, pp.100-110 (1949).

18. V. Paschkis, "Heat Transfer a Foundryman's Tool," *A.F.S. Trans.*, vol. 57, pp.310-314 (1949).

19. R. W. Ruddle, "The Solidification of Castings," *Report No. 7*, Institute of Metals (British) (1950).

20. V. Paschkis, "Influence of Dry Sand Conductivity on Rate of Freezing of Steel Slabs," *A.F.S. Trans.*, vol. 58, pp.147-152

21. H. F. Bishop, W. S. Pellini, "The Contribution of Riser and Chill Edge Effects of Soundness of Cast Steel Plates," *A.F.S. Trans.*, vol. 58, pp.185-197 (1950).

22. V. Paschkis, "Some Thermal Considerations in Foundry Work," *A.F.S. Trans.*, vol. 59, pp.7-19 (1951).

23. V. Paschkis, "Heat Flow in Moist Sand," *A.F.S. Trans.*, vol. 59, pp.381-391 (1951).

24. H. A. Schwartz, W. K. Bock, "Freezing of White Cast Iron in Green Sand Molds," *A.F.S. Trans.*, vol. 59, pp.488-493 (1951).

25. H. F. Bishop, F. A. Brandt, W. S. Pellini, "Solidification of Steel Against Sand and Chill Walls," *A.F.S. Trans.*, vol. 59, pp.435-450 (1951).

26. R. P. Dunphy, W. S. Pellini, "Solidification of Gray Iron in Sand Molds," *A.F.S. Trans.*, vol. 59, pp.425-434 (1951).

27. H. F. Bishop, E. T. Myskowski, W. S. Pellini, "The Contribution of Riser and Casting End Effects to Soundness of Cast Steel Bars," *A.F.S. Trans.*, vol. 59, pp.171-180 (1951).

28. V. Paschkis, "Heat Flow in Moist Sand," *A.F.S. Trans.*, vol. 60, (1952).

29. R. P. Dunphy, W. S. Pellini, "Solidification of Nodular Iron in Sand Molds," *A.F.S. Trans.*, vol. 60 (1952).

30. E. T. Myskowski, H. F. Bishop, W. S. Pellini, "Application of Chills to Increasing the Feeding Range of Risers," *A.F.S. Trans.*, vol. 60, (1952).

31. H. F. Bishop, F. A. Brandt, W. S. Pellini, "Solidification Mechanism of Steel Ingots," *Journal of Metals (A.I.M.E.)*, Jan. 1952, pp.44-54.

32. H. F. Bishop, W. S. Pellini, "Solidification of Metals," *Foundry*, Feb. 1952.

▶ *Calendar of future meetings and exhibits*

March

16-18. . Nat. Assoc. Waste Material Dealers, Inc.
Conrad Hilton, Chicago. 40th Annual Convention.

16-20. . Nat. Assoc. Corrosion Engrs.
Chicago. Symposium: *"Protective Coatings."*

17-18. . Steel Founders' Society
Edgewater Beach, Chicago. Annual Meeting.

18-20. . American Society of Tool Engineers
Hotel Statler, Detroit. 21st Annual Meeting.

19-20. . American Hot Dip Galvanizers Association, Inc.
Netherland Plaza Hotel, Cincinnati. Annual meeting.

23-27. . American Society for Metals
Pan-Pacific Auditorium, Los Angeles. Western metal congress and exposition.

24-25. . Foundry Health Conference
University of Wisconsin, Madison, Wis. Sponsored by A.F.S. and U. of W.

27. . Malleable Founders' Society
Drake Hotel, Chicago. Western sectional meeting.

April

31-April 2. . Magnesium Association
Washington National Guard Armory, Washington, D. C. First International Magnesium Exposition.

9-10. . Malleable Founders' Society
Cornell University, Ithaca, N. Y. 4th Annual market development conference.

20-22. . 1953 Metal Powder Show
Hotel Cleveland, Cleveland. Ninth Annual Meeting.

25-May 10. . Liege International Fair
Liege, Belgium.

May

4-8. . A.F.S. 57th Annual Convention
Chicago. Five-day, non-exhibit convention.

6-8. . American Society of Training Directors
Sheraton Plaza Hotel, Boston. Annual Conference.

15. . Malleable Founders' Society
Hotel Commodore, New York. Eastern sectional meeting.

18-22. . Material Handling Institute
Convention Hall, Philadelphia, 5th national materials handling exposition.

June

8-10. . Malleable Founders' Society
Homestead, Hot Springs, Va. Annual meeting.

15-19. . Int. Materials Exposition
Grand Central Palace, New York. Exposition of basic materials for industry.

29-July 3 . . American Society for Testing Materials
Chalfonte-Haddon Hall, Atlantic City, N. J. Annual Meeting.

September

17-18. . National Foundry Association
Plaza Hotel, New York. Annual meeting.

21-22. . Steel Founders' Society
Homestead, Hot Springs, Va. Fall meeting.

19-26. . International Foundry Congress
Paris, France. Host: Association Technique de Fonderie de France.

October

8-9. . Michigan Regional Conference
Michigan State College, East Lansing, Mich. Sponsored by A.F.S. Central Michigan, Western Michigan, Detroit and Saginaw Valley Chapters and Michigan State and University of Michigan Student Chapters.

8-9. . Gray Iron Founders' Society
New Hotel Jefferson, St. Louis. Annual meeting.

15-17. . Foundry Equipment Manufacturers' Association
Greenbrier, White Sulphur Springs, W. Va. Annual meeting.

19-23. . 35th Nat. Metal Exposition & Congress
Cleveland Public Auditorium, Cleveland.

November

4-6. . Steel Founders' Society
T & O Conference.

1954

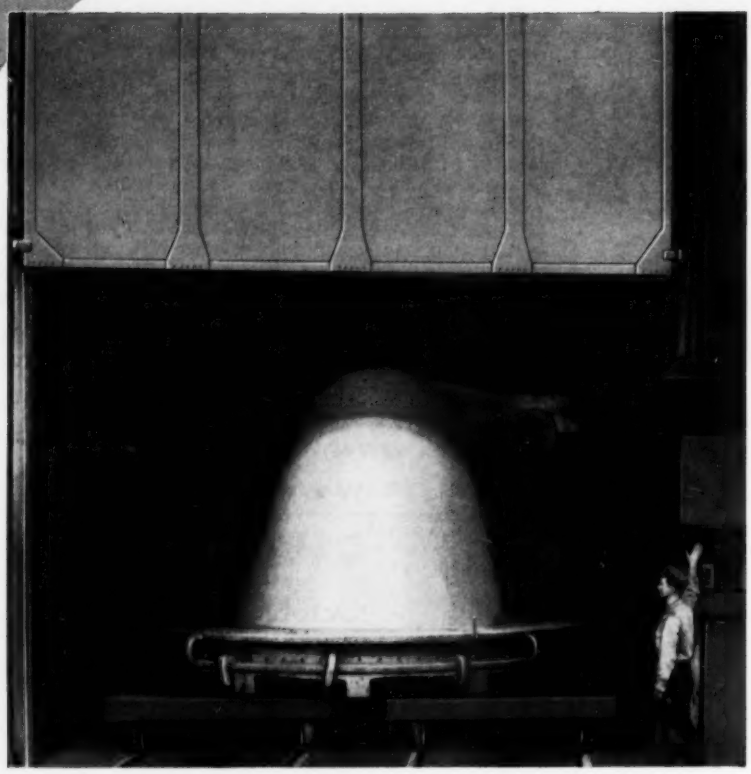
March

15-19. . Nat. Assn. Corrosion Engineers
Kansas City Municipal Auditorium, Kansas City. 1954 Conference & Exhibition.

May

5-7. . American Society of Training Directors
Schroeder Hotel, Milwaukee. Annual conference.

Another LARGE MOLD OVEN *installation by* CARL-MAYER



One of two Car Type Mold Drying Ovens at Pittsburgh Steel Foundry Corporation.

Size (each oven): 32'-0" deep x 18'-0" wide x 15'-0" high.

Individual gas and oil fired recirculating heating system. Heating arrangement provides for uniform temperature control, eliminates side wall ducts which might become damaged by shifting loads within the oven, and provides larger clearances.

Oven load capacity: 100 tons per charge.

PATENT APPLIED FOR

•

CARL-MAYER
products include:

VERTICAL CORE OVENS

•

HORIZONTAL CONVEYOR CORE OVENS

•

RACK TYPE CORE OVENS

•

ROLLING DRAWER CORE OVENS

•

OVENS AND FURNACES FOR OTHER PURPOSES

So much depends on the right selection of this type of oven equipment, that buyers check and double check—and compare engineering features critically before placing order.

Therefore, the choice of Carl-Mayer Ovens is a real endorsement of their all around leadership.

It will pay you to make consultation with Carl-Mayer engineers a MUST when on the market for foundry ovens. Write for New Bulletin No. 53-CM.

• • •

Carl-Mayer ovens are serving concerns like these:

Aluminum Co. of America
American Brake Shoe Co.
American Radiator Co.
Blaw-Knox Co.
Brown Industries
Buick Motor Div. of General Motors Corp.
Bucyrus-Erie Co.
Cadillac Motor Div. of General Motors Corp.
Columbia Steel Corp. (U. S. Steel Corp.)
Crucible Steel Castings Co.
Dunkirk Radiator Co.
Eclipse Aviation Division of Bendix Aviation Corp.
Electric Autolite Co.
Ford Motor Co.
Fremont Foundry Co.
General Electric Co.
General Motors Corp. and Subsidiaries
Gilbert & Barker Co.
General Steel Castings Co.
Golden Foundry Co., Inc.
Henry Kaiser Corp.
W. O. Larson Foundry Co.
Mesta Machine Co.
F. E. Meyers & Bro. Co.
Oil Well Supply Co. (U. S. Steel Corp.)
Packard Motor Car Co.
H. B. Salter Co.
Shenango Penn Mold Co.
Standard Foundry Co.
Union Brass & Metal Mfg. Co.
Union Steel Castings Co.
West Michigan Steel Castings Co.
Whiten Machine Works
Whiting Corp.
A. C. Williams Co.

THE CARL-MAYER CORPORATION

3030 Euclid Avenue • Cleveland, Ohio

BACKED BY REPUTATION AND OVER 30 YEARS' EXPERIENCE

Management learns latest in foundry health and safety

■ The second conference on foundry health, safety, and air pollution sponsored by A.F.S. and an educational institution was held February 17-19 at the University of Illinois. Conducted by the Society and the Department of Mechanical Engineering, the three-day meeting featured 16 speakers on various phases of safety, hygiene, and air pollution, and a visit to the Danville plant of General Motors Corporation's Central Foundry Division. Attending were representatives of foundries from seven states and some 25 members of the University of Illinois Student Chapter.

Following registration in the Illini Union Building where all the sessions were held, the conference was opened by Prof. N. A. Parker, University of Illinois. Conference attendants then saw the Claude B. Schneible Co. film *"The Invisible Shield"* portraying the use of air to screen workmen from heat, dust, and fume. A luncheon, with Dean C. M. Louttit as speaker, followed the opening session.

Three speakers appeared on the program in the afternoon. Session was under the chairmanship of Prof. K. J. Trigger. Robert E. Savage, International Nickel Co., New York, led off with a paper entitled *"Safety Practices in the Production of Ductile Iron."* No serious accidents have been reported and the objective is to establish and publicize safe practices before accidents do occur.

Shell molding not hazardous

H. J. Weber, American Brake Shoe Co., Chicago, spoke on *"Effect of Resin and Fluorine Fumes in Shell Molding."* Experience of his company so far, said Mr. Weber, indicates that health hazards directly associated with shell molding are not potentially severe. From a practical point of view, hazards from handling non-hydrolyzable silicones used as mold release agents appear at present to be exceedingly minor, he stated. Hydrolyzing types, he warned, are highly corrosive and present hazards from vapor inhalation and contact with skin and eyes.

The resins used in shell molding, Weber said, give off phenol, formaldehyde, ammonia, and carbon dioxide, depending on the type used. All are poisonous but in acute concentrations a man cannot tolerate toxic amounts. Thus, he declared, fumes will be at most a nuisance rather than a hazard. He also outlined the potential hazards in the preparation of sand-resin mixes and told how to eliminate them.

W. N. Davis, director of safety, hygiene, and air pollution for A.F.S., pointed out that the foundry need not be an unsafe place in which to work. Surveys indicate that injured persons have not been properly trained and that when careful training programs are instituted, frequency rates fall far below the average for the industry.

He outlined a safety training program in which the foreman is the instructor. Accident prevention consciousness must be developed so workmen will automatically react correctly to any unsafe condition, Mr. Davis said.

In the late afternoon, conference attendants went to the GMC plant at Danville where they toured the foundry in groups of four, guided by plant representatives. After viewing application of safe practices throughout the foundry, the group had dinner in the new plant dining room, with GMC playing host.

Misuse harmful materials

The conference continued the second day with a morning session at which Prof. James L. Leach presided. H. Downing, Lincoln Electric Co., Chicago, presented a practical paper on methods of controlling hazards connected with welding.

S. C. Rothmann, John Deere Co., Moline, Ill., said in his talk on labelling of hazardous materials that 7 per cent of the fatal and permanent total injuries in industry are caused by misuse of harmful substances.

Examining display of safety clothing in the Danville foundry of General Motors Corp. are, left to right: Prof. James L. Leach; Elmer Braun, assistant manufacturing manager, GMC Central Foundry Div.; Wm. N. Davis, A.F.S. safety, hygiene, and air pollution director; and Wm. H. Decker, safety supervisor, Danville plant.

One of the most effective lines of defense is proper labelling, he stated. He outlined some of the labelling laws now in existence and pointed out management's moral and legal responsibilities in preventing misuse of harmful materials.

Ray Moore, Claude B. Schneible Co., Detroit, spoke on *"Practical Control Methods of Foundry Air Pollution."* He directed attention to the sources of air pollution in the foundry and showed how plants can eliminate them or remove the pollutant from the atmosphere.

The morning session ended with a talk by Prof. J. O. Kraehenbuehl who described noise and its effect on the worker in a foundry. Noise is a new problem for foundry management, he said, in suggesting practical methods of control. He cited common, costly mistakes in installing acoustical materials.

At the luncheon, Dean H. H. Jordan presided and Charles Esgar, Foundry Educational Foundation, Cleveland, commented briefly on safety instruction received by engineering school students.

Most dust only nuisance

The afternoon session was devoted to facts on silicosis and methods of sampling dust and fume inside and outside the foundry. Prof. Carl E. Shubert was chairman. L. E. Hamlin of American Brake Shoe Co., Chicago, said much confusion and misunderstanding exists regarding harmful qualities of various dusts. Accumulated experience indicates, he declared, that the great majority of industrial dusts have little effect on health other than their nuisance value and contribution toward poor housekeeping. A good working environment demands that they be removed in spite of their innocuous characteristics, he added.

Dr. Hamlin distinguished between siderosis and silicosis and showed radiographs and data illustrating that the foundry is not as great a source of silicosis as it once was.

Lynn D. Wilson, Wilson Industrial Hygiene & Research Laboratory, Chicago, gave a brief history of dust and fume sampling methods, showing how dust surveys are carried out in the average foundry.

Nelson W. Hartz, Mine Safety Appliance Co., Pittsburgh, set up and demonstrated all the instruments used by the various authorities to measure air pollution.

The day ended with the conference dinner at which A.F.S. President I. R. Wagner, Electric Steel Castings Co., Indianapolis, Ind., was principal speaker. He prefaced his talk, *"Safety—a Part of Production,"* by telling how the Safety & Hygiene & Air Pollution Program was developed by A.F.S. at the request of the National Castings Council.

The most expensive item of production is labor, Mr. Wagner stated, which means that if each employee is not working to his best advantage, the cost of production goes up. Thus, safety is part of production, he said, and can be put on a dollar and cents basis. Above all, however, he emphasized, it is hoped that the safety work will preserve life and prevent suffering of employees.

A.F.S. SAFETY & HEALTH CONFERENCE
University of Wisconsin
March 24 and 25

A program of 15 sessions covering air pollution inside and outside of foundries, radiation hazards, housekeeping, industrial commission interest in health and safety, supervisor's responsibility, eye hazards, shell molding, electrical hazards, and medical and legal aspects of industrial noise will be presented in this third A.F.S. conference on safety, hygiene, and air pollution.

Enrollment can be made in advance through the Extension Division, University of Wisconsin, Madison, Wis. A fee of $15 covers cost of the course and materials but not room or meals.

Referring to Electric Steel Castings Co., Mr. Wagner said they found safety training not only increases efficiency and production, but also has helped employee relations. From his years of experience with a successful safety program, he concluded:

1. A successful safety program cuts production costs.

2. Top management must have an intimate knowledge of the safety program and give it constant attention, so that all employees will have a sustaining interest in it.

3. Safety is an attitude of mind and a habit which, like any other habit, can become part of us.

The final session of the conference was held the morning of the third day under the chairmanship of Dean Stanley H. Pierce. Kenneth M. Smith, Caterpillar Tractor Co., Peoria, Ill., stressed the importance of properly maintaining foundry ventilation equipment. Effective maintenance is achieved in three steps, he said: (1) Design rugged systems with the realization that many parts may require routine cleaning and eventual replacement; (2) Install all parts of a system with ease and speed of replacement in mind; and (3) Establish a routine procedure for observation and care of all systems by competent persons.

Mr. Smith cited sources of trouble in ventilation and dust collecting systems and told how to correct difficulties which might arise.

"Dermatitis Prevention in the Foundry Industry" was the topic of Floyd Van Atta, National Safety Council, Chicago. A dermatitis case is almost never a threat to life and is seldom disabling, he asserted, but is apt to be drawn out and is particularly apt to be recurrent. It is much easier to avoid than to cure.

Only a few compounds used in the foundry are general causes of dermatitis, Dr. Van Atta advised. Whatever causes a case of dermatitis, it is always the result of long continued contact of a sufficient concentration of some material with the skin.

Dermatitis can be prevented, according to Van Atta, through: (1) Ordinary good industrial housekeeping; (2) Good personal hygiene; (3) Protective equipment and creams; and (4) Proper choice of employees.

Prof. George W. Harper discussed material handling, pointing out that the average foundry must handle 150 to 200 tons of materials to produce one ton of finished castings. Material handling is responsible for 25 per cent of the disabling injuries in all of industry, he asserted and described methods of prevention and of training employees in proper handling of materials.

Final address of the conference was on safe storage, handling, and use of magnesium. Fred P. Strieter, Dow Chemical Co., Midland, Mich., told how foundrymen can handle magnesium safely and described the various codes developed by the National Board of Fire Underwriters.

The conference closed with a luncheon at which registrants received certificates of participation from Dean S. C. Robinson, and Prof. R. K. Newton commented on engineering extension work.

Shop talk

Practical questions and answers

▶ Needs wear, machinability

Can you suggest an analysis for iron castings for dredge pump castings and impellers? Abrasion resistance and toughness are important but the castings must still be machinable with conventional equipment using carbide tools. The castings should not be brittle as the peening action of stones would cause chipping. Stresses and corrosion are not problems in this application.

Your requirements of abrasion resistance and toughness without loss of machinability are diametrically opposed. You will have to make a choice as to which is more important and compromise on some combination of these properties. For maximum wear resistance, you might try an iron of the following composition: Total carbon, 3.10-3.60 per cent; Si, 0.50-1.00; S, 0.12 max.; P, 0.10-0.20; Mn, 0.40-0.60; Ni, 4.50-5.00; and Cr, 1.50-2.00. The hardness of such an iron will be approximately 500 Brinell which will make it extremely difficult to machine.

An alternative is to use an iron with a minimum tensile strength of 40,000 psi with a composition such as: Total carbon, 3.10-3.30 per cent; Si, 1.80-2.00; S, 0.13 max.; P, 0.25 max.; Mn, 0.55-0.75; Ni, 1.80-2.20; and Cr, 0.55-0.75. Such an iron in the sections involved in your castings will usually Brinell in the range of 210 to 260. Machinability will be superior to the first analysis. Wear resistance will be moderately good, but not as good as that of the harder material.

▶ White cast iron

Can you give us some information regarding white cast iron? We normally make gray iron.

White iron castings can be made from iron of ordinary gray iron composition but having an unusually low silicon content. Silicon content depends on the section thickness of the proposed castings, and normally would be 0.45 to 0.55 per cent.

White iron can be produced also by adding powerful carbide stabilizing elements such as chromium in sufficient quantities. The heavier the casting section, the higher the chromium content will have to be.

Considerable information on white and chilled iron is available in the A.F.S. publication *Alloy Cast Irons Handbook*.

For such experimenting, some chill blocks approximately 1½ x 4 x 6 in., can be cast with the 1½ x 6-in. face against a vertical chiller. After cooling to a dull red heat, quench the block in water and break it with a hammer to examine the depth of chill. The chill on the test block may then be compared with the chill on the actual casting and used as a control point for future castings.

The chiller should be of gray iron and coated with a paint of lamp black suspended in shellac, then thoroughly dried to avoid boiling of the metal from volatilization of any residual alcohol in the shellac.

▶ Cupola safety measures

We are interested in safe methods for blocking off the opening of our cupola directly at the charging floor level so that no objects can accidentally fall through from the charging floor nor loose pieces of cinder or other material fall through from the stack above the charging floor area while repair men are inside the cupola.

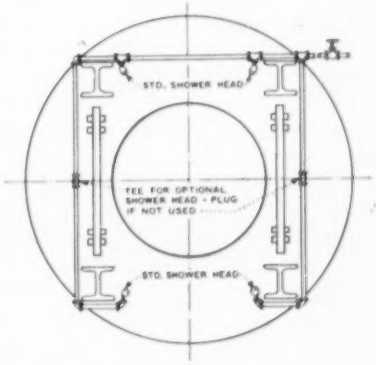
In many foundries it is the practice to close off the stack at the charging level by means of a platform or screen inserted through the charging door. Such a platform can be handled by monorail or hoist, or by hand, depending on the size and facilities available. Workers inside the cupola often wear hard hats to further protect themselves.

continued on page 74

now, there's an idea!

■ An improvement on the hose or buckets of water used in some foundries to quench the cupola drop at the end of a heat has been devised by D. W. Harris, Frank Wheatley Pump & Valve Mfr., Tulsa, Okla. His development is similar to that of Prof. Fulton Holtby of the University of Minnesota who some 12 years ago mounted a rectangle of ½-in. water pipe under the school's cupola. The two sides of the rectangle not blocked off by the bottom doors in the open position were drilled with a row of holes arranged at various angles to spray on the drop when the water valve was open.

Bill Harris has some improvements. With shower heads from a dismantled washroom and pipe from a pile of purchased scrap, he had the cupola tender make the arrangement shown in the adjoining sketch. The rectangle of pipe was mounted on four brackets welded to the cupola legs and tied into an existing water line to complete the job.



Salvaged shower heads and scrap pipe were used to make this cupola drop quencher by D. W. Harris, Frank Wheatley Pump & Valve Mfr., Tulsa, Okla.

▶ *Has foundry sand supply*

We have a supply of extremely fine sand of high silica content which we feel might be useful in foundry molding. We understand molding sand specifications are governed largely by the type of metal being cast and the size of the casting. How might we obtain a set of applicable specifications?

The most complete coverage on foundry sand is contained in two A.F.S. publications *Foundry Sand Handbook* and *Foundry Core Practice*. There is no generally accepted purchase specification for foundry sand. Each foundry orders sand to a specification which has been found best suited for its individual requirements, as to: sieve analysis, clay content, and chemical analysis. Others may specify a fineness test, moisture content, permeability, green strength, etc. The above factors are covered in detail in the publications mentioned.

▶ *Wants chilled castings*

We wish to produce castings with a hard smooth surface, such as casting against chill might give. The castings average about 18 in. long, 8 in. wide, and ½ in. thick. They are reinforced on the back by ¼ x ½ in. ribs. The front side will be ground smooth if we are unable to cast it with a smooth surface. What can be done about this?

An iron having 3.50 to 3.60 per cent total carbon with silicon approximating 1.25 per cent cast against a gray iron chill should develop a chill depth of ⅛ to ¼ in. on the casting. It will be necessary to regulate the silicon to control the depth of chill.

▶ *How to use borings*

We have from 85 to 100 tons of steel shavings and cast iron borings from our plant each year. Is it good practice to bale or make bricks from this material and use it to charge into our cupola?

The use of briquetted borings has proved very economical and successful in the cupola. While it is usually not satisfactory to use an entire charge consisting of such briquetted material, a percentage from 15 to 20 works out very well, if the material is processed so as to yield a brick sufficiently dense to resist break-down in charging and to avoid oxidation. Several companies make briquetting equipment of this type.

Recently a British company has developed a method of feeding loose borings through the stack which is reported to be successful.

▶ *Brass casting roughness*

What would cause surface roughness and adhering sand on thin, 4-oz. yellow brass castings? How can it be avoided? Our pouring temperature is 1950 to 2000 F.

The roughness and adhering sand are undoubtedly caused by metal penetration into the face of the mold. This could be caused by any one of the following factors:

1. Soft ramming of the mold. Look for evidence of uneven ramming.
2. Facing sand, if used, may not have been riddled through a fine enough screen.
3. Improper grain distribution in the molding sand, resulting in too high permeability. The proper proportion of fine sand results in closing some of the voids between large grains, cutting down metal penetration into the sand face.
4. Improper sand preparation prevents uniform distribution of the bond and the sand grains.
5. Poor flowability of sand, resulting in improper compactness, particularly at the surface of the pattern. With this the sand surface is not dense enough to prevent metal penetration.

▶ *Rammed up and poured*

Maintenance Man's Lament

I am the sad maintenance man you hear so much about;
The foundry guys all yell at me whenever I venture out,
I'm noted for my sloppy work, no matter what I do;
Now, everybody hates me, and I hope you hate me, too.

When I get here in the morning I am looking for the worst,
For everything's broke down and everybody wants me first.
I rush my damfool head off to fix things up, and then
The crazy devils go to work and break it down again.

I don't get time to eat my lunch, or smoke or drink a beer,
And I haven't had a day off in many, many a year.
I'm fixing cranes and sand mills every day, all kinds of weather,
And they rout me out of bed to put a belt together.

Fix the shakeout in the dog house! Fix an air hose on the floor!
Something wrong with George's blow machine! Can't make a single core!
I look for grief and trouble when I enter through the door
But—what the hell! I guess that's what maintenance men are for!

From the book *Rammed Up and Poured*, by Bill Watkins, copyrighted by the Electric Steel Foundry Co.

And Stuff Like That

Now some guys like to set up cores
And spend their time on dry sand floors,
But I would rather put my mitts
On bucket backs or bails or lips,
Or crusher jaws and over skips,
And stuff like that.

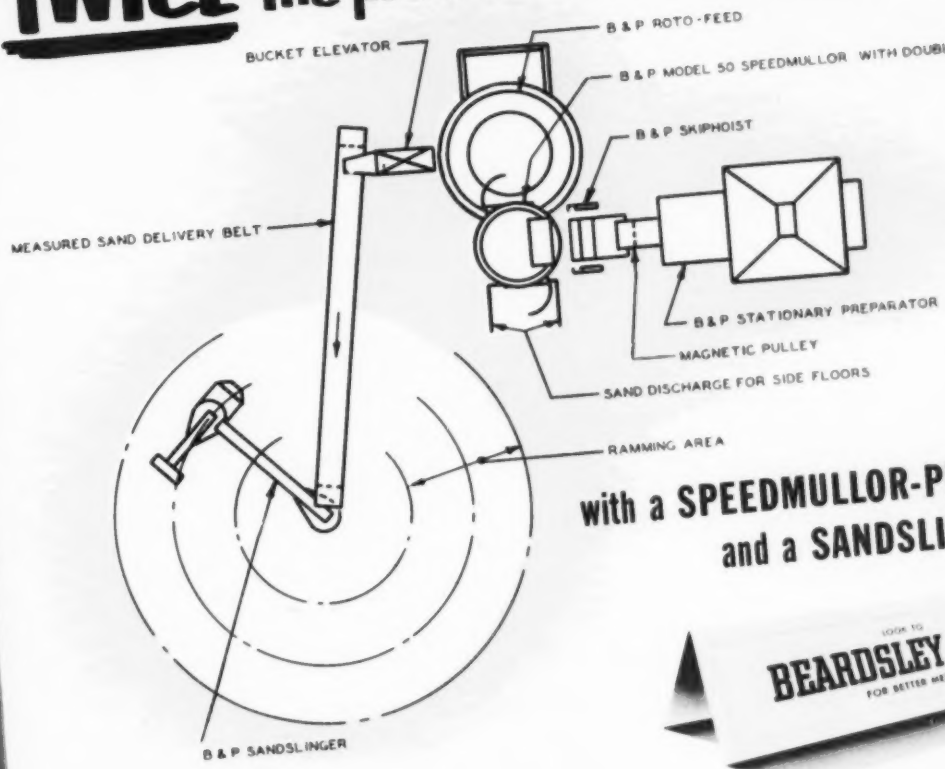
While molding is key work, that's true,
It's not the only job to do.
I'd rather line a ladle spout,
Fill up the molds and shake them out,
Make sand, or walk the watchman's route,
And stuff like that.

While there are guys who like to sit
Behind a desk—I wouldn't fit.
For my part, I would rather feel
The crunch of sand beneath my heel,
The smoke and heat of molten steel,
And stuff like that.

Some fellows like their cards and dice,
And though I've tried it once or twice
And found it fun, and kinda nice,
Sometimes I'm loath to pay the price.
So I'll take a song, and beer on ice,
And stuff like that.

And though some mugs will wink and flirt
With anything that wears a skirt,
Though office chicks have shiny curls
And ruby lips and teeth like pearls,
I still prefer the core room girls,
And stuff like that.

TWICE the production at KEUTHAN FOUNDRY


BUCKET ELEVATOR
B & P ROTO-FEED
B & P MODEL 50 SPEEDMULLOR WITH DOUBLE DISCHARGE DOORS
B & P SKIPHOIST
MEASURED SAND DELIVERY BELT
B & P STATIONARY PREPARATOR
MAGNETIC PULLEY
SAND DISCHARGE FOR SIDE FLOORS
RAMMING AREA
B & P SANDSLINGER

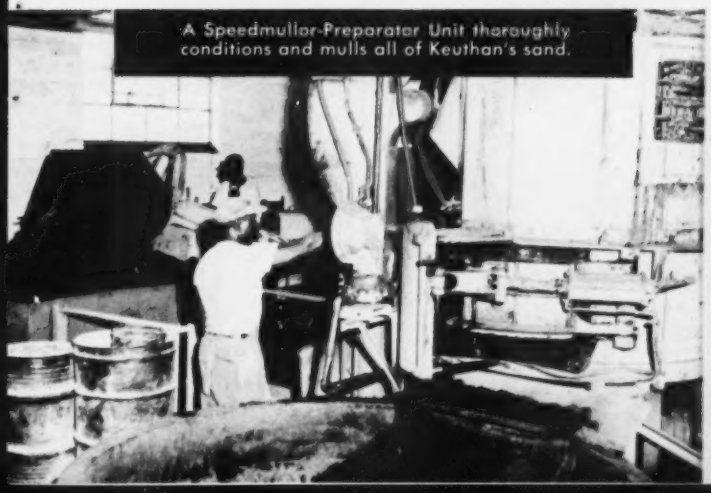
with a SPEEDMULLOR-PREPARATOR UNIT and a SANDSLINGER

LOOK TO
BEARDSLEY & PIPER
FOR BETTER METHODS

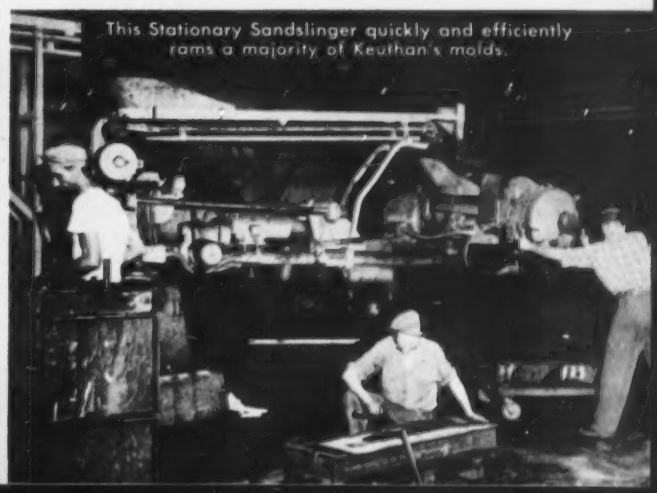
When the Black-Clawson Company, well-known manufacturer of papermaking machinery, took over the Keuthan Foundry of Middletown, Ohio, production bottlenecks were limiting output to less than eight tons a day.

Then the foundry installed a Speedmullor-Preparator Unit to thoroughly mull and prepare all of the foundry's molding sand, and a Sandslinger to ram the bulk of the foundry's molds. The cost of this mechanization was surprisingly low . . . yet capacity at Keuthan Foundry has been *doubled!* Quality is up and costs are down!

Whether you operate a small or large foundry, you can't afford to pass up the production boosting, cost-cutting possibilities of Sandslingers and Speedmullor-Preparator sand conditioning and mulling units. Write today for complete information on this equipment! Beardsley & Piper, Div. Pettibone Mulliken Corp., 2424 North Cicero Avenue, Chicago 39, Illinois.



A Speedmullor-Preparator Unit thoroughly conditions and mulls all of Keuthan's sand.



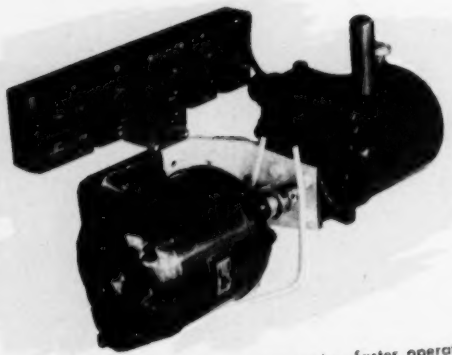
This Stationary Sandslinger quickly and efficiently rams a majority of Keuthan's molds.

The 1953

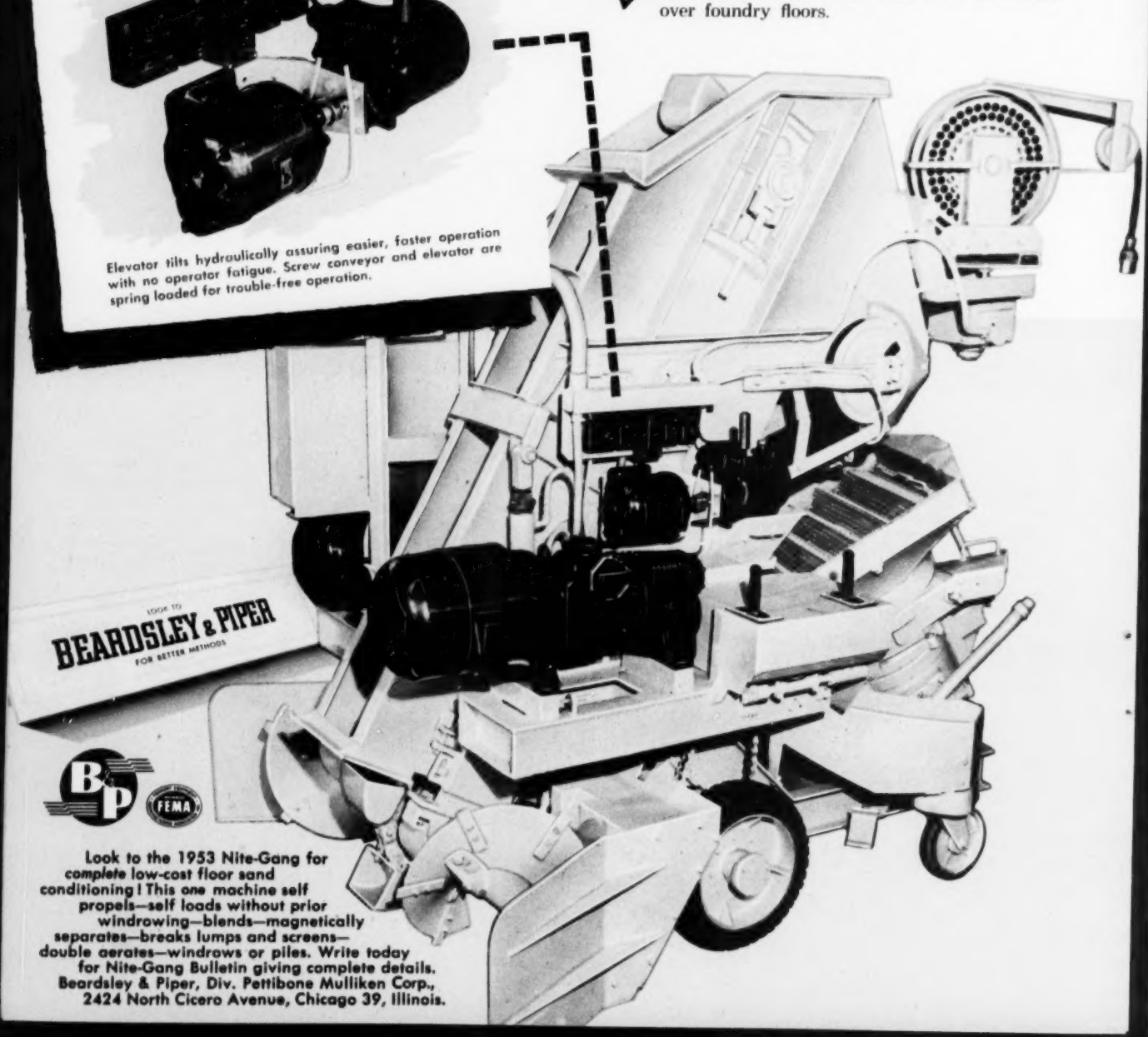
NITE-GANG

provides more important features!

- ✔ An automatic cable reel swivels in any direction—eliminates dragging cable.
- ✔ High capacity Screenarator unit with wear surfaces borium coated. High efficiency screw conveyor with borium coated edge.
- ✔ Elevator sprocket and chain bushing of special high alloy steel.
- ✔ A full 24 to 1 speed ratio—speed infinitely variable.
- ✔ Centralized lubrication for conveyor screw bearings takes guesswork out of maintenance.
- ✔ Screenarator unit rotates a full 240 degrees on hardened and ground bearing plates—sand may be directed where you want it.
- ✔ Tramp iron and shot separation by permanent magnet—no rectifier required.
- ✔ Cushioned airless rubber tires—ease movement over foundry floors.



Elevator tilts hydraulically assuring easier, faster operation with no operator fatigue. Screw conveyor and elevator are spring loaded for trouble-free operation.



LOOK TO
BEARDSLEY & PIPER
FOR BETTER METHODS

B P

FEMA

Look to the 1953 Nite-Gang for *complete* low-cost floor sand conditioning! This one machine self propels—self loads without prior windrowing—blends—magnetically separates—breaks lumps and screens—double aerates—windrows or piles. Write today for Nite-Gang Bulletin giving complete details. Beardsley & Piper, Div. Pettibone Mulliken Corp., 2424 North Cicero Avenue, Chicago 39, Illinois.

Elements in the cause and cure of residual stresses in cast iron

L. A. ALDINGER / *Sen. Res. Engr., Research Laboratories Div., GMC.*

■ Unfavorable residual stresses in castings are especially detrimental in applications where the loading is high or the configuration of the casting is such that certain portions are highly stressed. Where applied load and residual tensile stress are additive, the total stress may exceed the strength of the iron and result in failure. Dimensional stability is another important consideration since castings containing residual stresses will usually distort.

The following factors are responsible for most of the residual stress found in castings:

1. Differential solidification and cooling of the casting after pouring.
2. Restricting influence of the mold which prevents normal contraction of the casting during cooling.
3. Blast cleaning which may introduce unfavorable stresses, especially in the interior surfaces of relatively thin outer walls.

These factors may be controlled to some extent by revisions in foundry practice. Design of gates and risers is important for controlled solidification can do much toward minimizing strain. Raising the shakeout temperature to minimize the restricting influence of the molding sand is often helpful. Figure 1 shows the effect of considerable residual stress in a casting produced by grit blast cleaning, after stress relief annealing.

Blasting the exterior surface of the top deck has caused it to assume a convex shape after parting from the original section. The compressive stress in the exterior surface induced by blasting resulted in relatively high tensile stresses in the fillets joining the cylindrical columns, between the ports, and the top deck. The fire deck, which has a much thicker cross-section was considerably less affected by the cleaning treatment. In cases like this the blasting intensity may have to be reduced or it may be necessary to stress relieve after grit blasting.

If the residual stress is reasonably high it may be assumed that, in time, some relaxation may occur, especially under the influence of mild

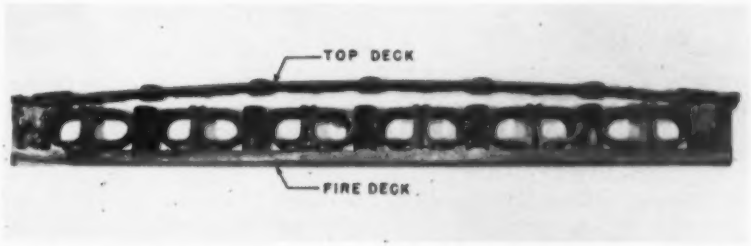


Fig. 1 . . Cylinder head sectioned and cut shows effect of residual stress in top deck.

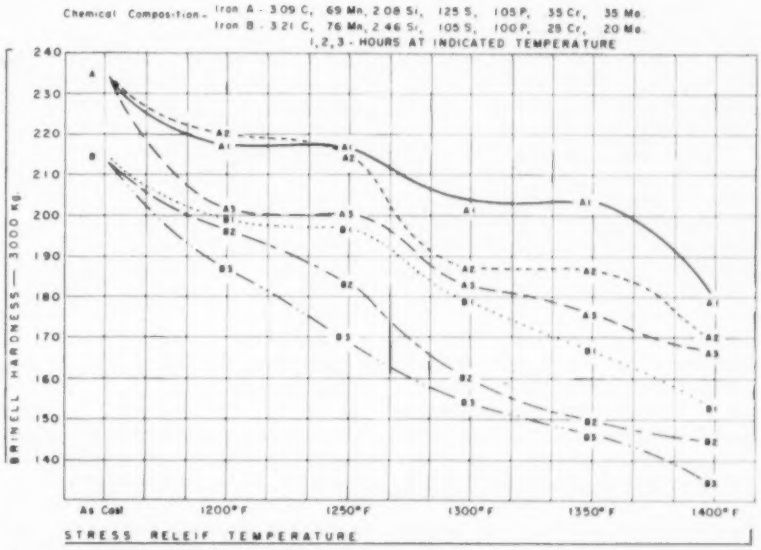


Fig. 2 . . Loss in hardness of two irons treated for various times and temperatures.

temperature changes. This was the theory behind the now almost obsolete practice of aging castings from 6 months to a year before placing them in service. In many cases, such aging afforded sufficient relaxation to prevent service failure.

Stress relieving of cast iron usually implies heating to between 900 F and the Ae_1 lower critical temperature, for a period of at least one hour for each inch of section. The heating cycle must be carefully controlled, since the temperature involved may result in microstructural changes in the iron that could appreciably lower the strength of the casting. However, for adequate stress relief, it is advisable to heat to as high a temperature as possible, without lowering the mechanical properties below the level specified for the particular casting treated.

Stress relief induces creep, at elevated temperature, in the strained portions of the casting which results

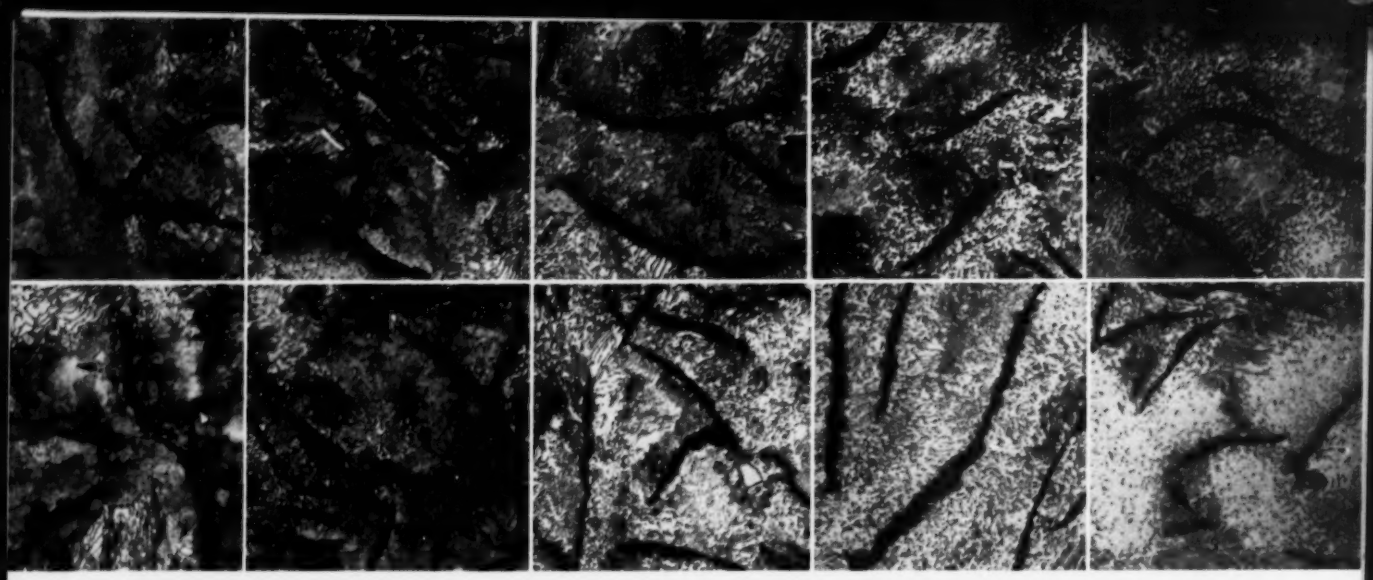


Fig. 3 . . Change in microstructured (X500) of two cylinder irons stress relieved for three hours. Top row is iron A, bottom row is iron B. From left to right: as cast; annealed at 1200 F; at 1250 F; at 1300 F; and at 1350 F.

in relaxation of the residual stress. Total deformation is a function of initial stress, annealing temperature, time of annealing, and composition of the iron. Creep rate is relatively rapid during the first hour of heating and decreases with additional time at temperature. Therefore, it is advisable to stress relieve at least one hour at heat regardless of section size and in many cases three to four hours would be preferable.

Certain foundries transfer their castings into an oven directly after shakeout before cooling to room temperature. In this manner, the sensible heat in the casting is utilized to advantage and stresses resulting from differential cooling after shakeout are minimized.

Loss of mechanical properties during stress relieving results from decomposition of the as-cast pearlitic microstructure at elevated temperatures. The effect on the microstructure depends to a large extent upon the composition. The amount of carbon and silicon present, as well as the ratio between these two elements, affects not only the as-cast mechanical properties but also the response to stress relieving. Certain alloy additions strengthen iron, as-cast, and also stabilize the pearlitic structure during stress relief in such a manner that higher temperatures can be tolerated without the loss in mechanical properties that would be experienced with plain cast irons. Alloy cast iron also requires a higher temperature or longer time at temperature, to effect the same degree of stress relief, since the creep rate will be lower than in plain iron.

Two methods commonly available to the production metallurgist for determining how stress relief treatment is affecting the as-cast mechanical properties are hardness after treatment and rate of decomposition of pearlite. Following a series of stress relief treatments, a study was made of the change in hardness and microstructure in two compositions of cylinder iron as shown below. The composition of cast iron A results in a higher as-cast hardness than iron B due to the lower carbon-silicon balance and slightly higher alloy content.

	A	B
Carbon	3.09%	3.21%
Manganese	.69	.76
Silicon	2.08	2.46
Sulfur	.12	.10
Phosphorus	.10	.10
Chromium	.35	.25
Molybdenum	.35	.20
Bhn (as-cast)	235	212

The samples used in this investigation were sections from arbitration test bars, 1.2 in. in diameter x 21 in. long, cast from each of the two compositions. Specimens of each iron were heated to 1200 F, 1250 F, 1300 F, 1350 F and 1400 F for 1, 2 and 3 hours at temperature.

Decrease in hardness, which is a measure of the rate of decomposition of the pearlitic structure, is a function of time at a given elevated temperature, as shown in Fig. 2. Cast iron A which has the higher as-cast hardness of the two irons also maintains a higher hardness than iron B after comparable stress relief treatments. Consider a hypothetical case wherein the mechanical properties associated with a final hardness of 180 Brinell are desired. For a one-hour treatment the maximum temperature for iron B would be approximately 1300 F. This could be raised to 1400 F for treatment of iron A to that same hardness. Using a three-hour stress relief these temperatures would have to be lowered to 1225 F and 1325 F for irons B and A, respectively.

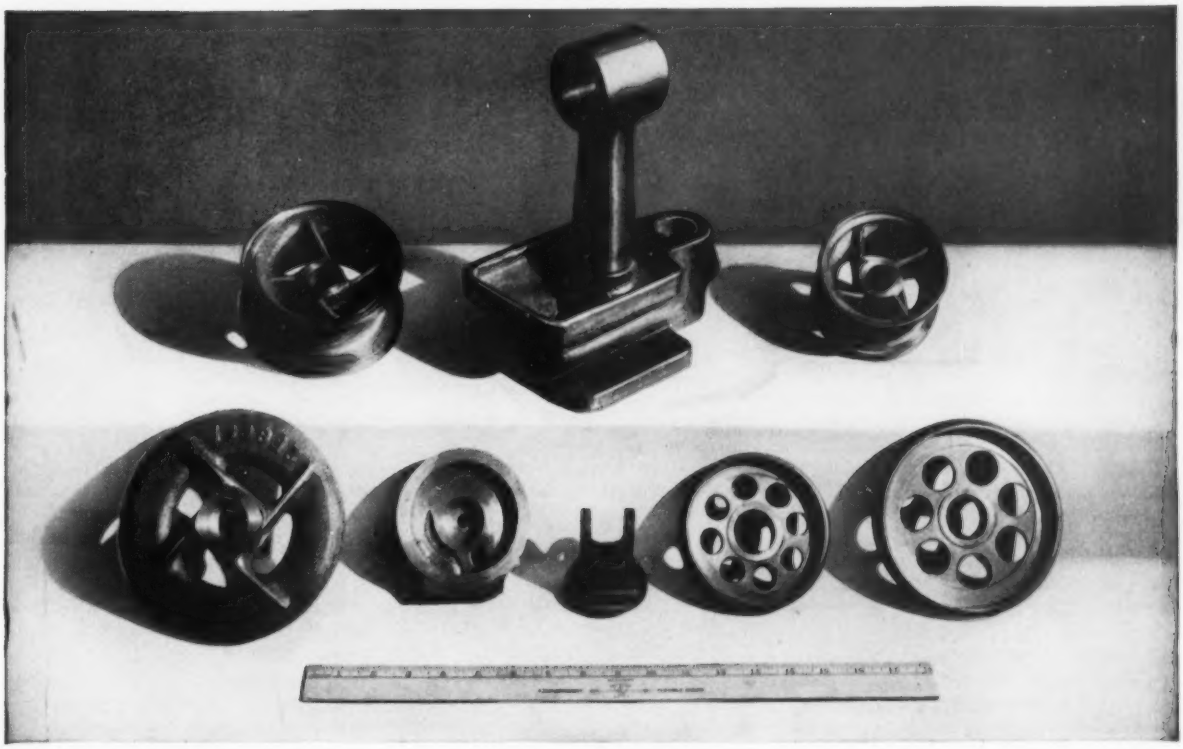
Microstructure of the two cast irons, before and after heating for three hours at temperatures of 1200 F, 1250 F, 1300 F, and 1350 F are shown in Fig. 3. The three-hour treatment was selected to emphasize microstructural changes, in the pearlitic matrix of each iron, with respect to temperature. The structure of the two irons, as-cast, is quite similar with the exception of a somewhat larger amount of coarse pearlite in iron B. The first metallographic evidence of spheroidization, resulting from stress relieving, appears in cast iron B after treatments for three hours at 1200 F. Cast iron A does not reveal any appreciable structural change below 1250 F. The decrease in hardness observed in both irons after annealing at 1200 F for one hour indicated that some small structural change had occurred which was not observed in the microstructure at X500 magnification. Comparison of the three photomicrographs at the right reveals a more rapid rate of pearlite decomposition in iron B than in iron A. This condition is especially apparent in the second from the right which shows a greater degree of spheroidization in the microstructure of cast iron B than in iron A.

Acknowledgment is given to E. R. Mantel, Research Laboratories Div., GMC, for the photomicrographs.

NISILOY*

to eliminate hard chilled areas in gray iron castings

. . . REDUCE machining time, tool wear, rejections



Produce *machinable* gray iron castings regardless of sharp variations in section thickness . . .

Eliminate localized hard areas or chilled (white) edges and surfaces . . .

Reduce machining time, tool wear and rejections . . . *raise both quality and quantity of your output by controlling gray iron structure with small ladle additions of NISILOY.*

Designed specifically to promote better machinability, NISILOY is a powerful innoculant and graphitizer containing about 60% Nickel, 30% silicon, balance essentially iron.

*Trade Mark of The International Nickel Company, Inc.

Mail the coupon now . . . for your *free* copy of a booklet that describes how Nisiloy helps you improve structure and machinability of gray iron castings.

EMBLEM OF INCO SERVICE
TRADE MARK

THE INTERNATIONAL NICKEL COMPANY, INC.
Dept. AF, 67 Wall Street, New York 5, N. Y.

Please send me your booklet entitled,
"NISILOY" for GRAY IRON CASTINGS.

Name.....*Title*.....

Company.....

Address.....

City.....*State*.....

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

Speakers cover field of foundry technology

At 16th Wisconsin conference

The 1953 Wisconsin Regional Foundry Conference story has been prepared in cooperation with the conference publicity chairman, D. M. Gerlinger, Walter Gerlinger Inc., Milwaukee, and a number of the session chairmen and co-chairmen and conference committee members.

■ Opening again this year with a keynote technical address on a major activity of the industry—the A.F.S. Safety & Hygiene & Air Pollution Program—the annual Wisconsin Regional Foundry Conference was held February 12 and 13 at the Schroeder Hotel, Milwaukee. Sponsored by the Wisconsin Chapter in cooperation with the University of Wisconsin, the 1953 conference had as chairman A. F. Pfeiffer, Allis-Chalmers Mfg. Co., Milwaukee.

J. G. Risney, Risney Foundry Equipment Co., Milwaukee, started the conference the morning of February 12 by introducing A.F.S. President I. R. Wagner, Electric Steel Castings Co., Indianapolis, Ind. Mr. Wagner lauded Wisconsin foundrymen for developing a conference program which closely paralleled Society activities. He outlined A.F.S. operations as carried out locally by the 56 chapters, through the more than 100 national technical committees, the Society-sponsored research projects, the publication of over 60 books and bulletins in addition to the annual *Transactions* and the monthly AMERICAN FOUNDRYMAN.

Stake in S & H & A P program

The industry needs to develop its own engineering standards of working conditions, Mr. Wagner stated, in calling attention to the Safety & Hygiene & Air Pollution Program now actively under way. The program is expected to cost $350,000 over a period of ten years, he said and is being financed by contributions from the industry. He urged support for the program, warning that if the foundry industry doesn't do the job, some enforcement agency will.

M. O. Withey, dean of engineering at the University of Wisconsin, outlined problems in engineering education and suggested the development of more technical institute type of training to provide technicians who could release much-in-demand engineering college graduates for other jobs.

Co-chairman of the opening session, Prof. George J. Barker of the University, introduced Walter F. Scholtz, Allis-Chalmers Mfg. Co., who spoke on *"Their Health is Our Business."*

In his speech, Mr. Scholtz emphasized that foundry management has a prime responsibility for providing employees with a safe and healthy place to work. To point out potential health hazards, he took the group on an imaginary tour of a typical foundry, showing slides of many operations.

Harmful concentrations of methyl alcohol vapor from shellac pots can be avoided in the pattern shop by substituting ethyl or some other less harmful alcohol as a thinner, Mr. Scholtz said. Sufficient ventilation should be provided around the cupola, he warned, to remove carbon monoxide, sulphur dioxide, and hydrogen sulphide, he warned. Acrolein, a gas formed by partial oxidation of core oils during pouring, can be reduced by selecting oils that don't break down readily.

In non-ferrous foundries, lead and zinc fume concentrations should be kept low by adequate ventilation of melting, skimming, and pouring operations, Scholtz said, and he recommended periodic urinalyses for exposed employees. Dermatitis is best controlled through good personal hygiene, he declared, adding that resins sometimes sensitize individuals so that continued exposure becomes impossible.

Edward A. McFaul, Chicago, spoke on *"How's Your Sense of Humor?"* at lunch. Chairman of the first luncheon meeting was A. F. Pfeiffer.

The first of four rounds of sectional meetings on steel, gray iron, malleable, non-ferrous, and patterns followed the luncheon. William S. Pellini, Naval Research Laboratory, Washington, D. C., spoke on *"Strain Theory of Hot Tearing"* before the steel group. E. Tetzlaff, Pelton Steel Casting Co., Milwaukee, and A. Hermann, Racine Steel Co., Racine, were co-chairmen.

Foolproof sand

At the gray iron session, J. S. Schumacher, Hill & Griffith Co., Cincinnati, spoke on *"Foolproof Sand Works for a Wide Range of Castings."* Co-chairmen were C. W. Schwenn, Brillion Iron Works, Inc., Brillion, and E. Wussow, Kaukauna Machine Co., Kaukauna.

Frank S. Brewster, Harry W. Dietert Co., Detroit, addressed the malleable group, discussing *"How to Get More Production with Controlled Sand."* K. Grobschmidt, Badger Malleable, South Milwaukee, was chairman, with H. L. Zellmer, Chain Belt Co., Milwaukee, as co-chairman.

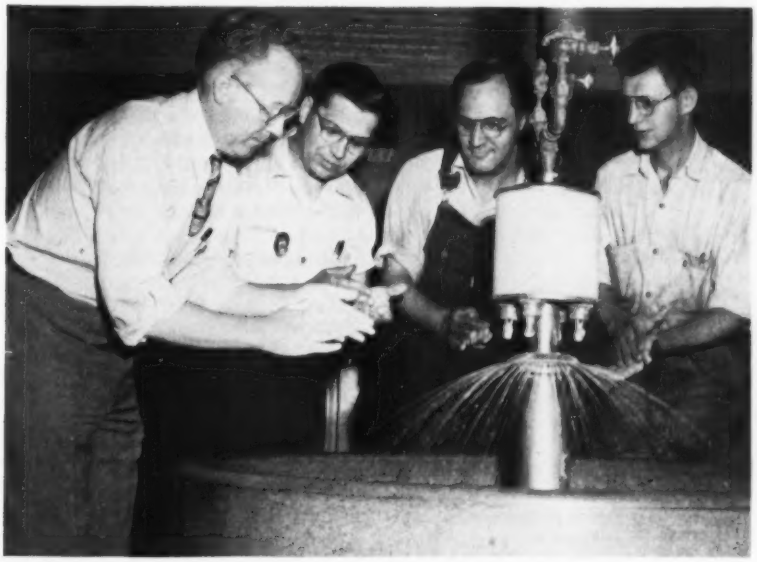
"Fracture Test for Melt Quality" was the subject of George P. Halliwell, H. Kramer & Co., Chicago, speaking before the non-ferrous group. Co-chairmen were C. Van Buren, Allis-Chalmers Mfg. Co., and H. Seeboth, Waste Paper Specialties, Inc., Milwaukee.

J. W. Costello, American Hoist & Derrick Co., St. Paul, Minn., spoke on *"Pattern Equipment as it Affects Foundry Equipment."* R. J. Christensen, Wisconsin Pattern Works, Inc., Racine, and W. Kollmorgen, Kollmorgen Pattern Works, Milwaukee, were co-chairmen.

Hot tears, Mr. Pellini told the steel foundrymen, are fractures through liquid films which exist at or near solidus temperatures. Hot tearing is primarily the result of hot spots and restraint during solidification, although sulphur and phosphorus contents of about 0.06 per cent and

higher tend to promote hot tearing, he said.

Grain distribution predominantly on the 50, 70, 100, and 140 mesh screens gives a sand that is easy to control, can't be over-rammed, gives good finish on large and small castings, has good moisture tolerance, and causes low scrap, Mr. Schumacher said, in citing the advantages of a four-screen, foolproof sand for the gray iron group. A particularly favorable feature in addition, he declared, is the uniform hardness of vertical surfaces. He recommended a sand mixture containing about 6 per cent southern bentonite, 2 per cent carbonaceous material including some cellulose, and 3-3.5 per cent moisture.



Grownups, too, need to be told how to wash. Walter F. Scholtz, supervisor of industrial hygiene, Allis-Chalmers Mfg. Co. (left), demonstrates the proper method of removing shop dirt as a primary step in controlling dermatitis.

Mr. Brewster reminded his listeners at the malleable session that sand control means higher production. He listed sources of wasted time such as nailing, tucking, excessive ramming, pounding on hoppers, sticky sand, and difficult shakeout which can be eliminated through sand control.

At the non-ferrous session, Mr. Halliwell said that 50 per cent of the copper-base alloy foundryman's trouble is due to gas in the metal. He described the pouring, casting, fracturing, and interpretation of the fracture test developed under the A.F.S. Brass & Bronze Research Committee and urged its use.

Speaking to the pattern group, Mr. Costello reviewed pattern fundamentals and urged patternmakers, insofar as possible, to: (1) suit patterns to standard flask equipment and make plates large enough to fit any standard flask in the shop; (2) construct pattern equipment so it can be used on several types of molding machines; (3) make equipment which will stand abuse of molding; and (4) produce core boxes which can be used with a blower, roll-over machine, or rammed by hand.

The second steel session featured a presentation by Clyde Wyman, Charles Fuerst, and George Di Sylvestro, all of Burnside Steel Foundry Co., Chicago, on *"Evaluation of Core Sand Binders."* From an extensive study, they concluded: (1) Resins are least susceptible to loss of tensile strength at 100 per cent relative humidity; (2) tendency to hot tear increases with rammed density and with hot strength; (3) tendency to spall and crack increases with the saponification number of an oil; and (4) tendency to spall and glaze increases with the acid number.

Duane Bosma, Bucyrus-Erie Co., South Milwaukee, and W. Punko, Wehr Steel Co., West Allis, were chairman and co-chairman.

Daniel E. Krause, Gray Iron Research Institute, Columbus, Ohio, reviewed research to determine how iron and steel melt in a cupola at the second gray iron session. Chairman was H. Schwengel, Modern Equipment Co., Port Washington; co-chairman was T. Tanner, Zenith Foundry Co., West Allis.

Mr. Krause described work done in this country and in England in which cupolas were quenched in the middle of a heat, after the blast was shut off. Picking out pieces of the charge and studying them revealed, he said, that long pieces of metal tend to orient themselves vertically as they descend. Steel, he stated, picks up sulphur shortly after charging but tends to lose it as it reaches the melting zone.

At the second malleable meeting, Russell L. King, Bay State Abrasive Products Co., Chicago, explained grinding wheel markings and advised ordering "C" abrasive (silicon carbide) for low tensile strength materials, "A" abrasive (aluminum oxide) for all others.

J. Kropka, Chain Belt Co., Milwaukee, was malleable session chairman; N. Amrhein, Federal Malleable, West Allis, was co-chairman.

Mull synthetic sand

Discussing sands at the second non-ferrous meeting, George Anselman, Beloit Foundry Co., Beloit, stated that to get the most from a true synthetic sand mixture required the use of some type of muller. Semi-synthetic sands are ideal for the non-ferrous shop, he said.

Elmer Blake, Osborn Mfg. Co., Cleveland, Ohio, described *"Design of Core Boxes and Dryers for Core Blowing"* at the second pattern session. Co-chairmen were H. Arneson, Spring City Pattern Works, Inc., Waukesha, and M. Ehrman, International Harvester Co., Milwaukee.

Mr. Blake outlined proper construction methods for solving special core problems and described newly developed coreblowing equipment.

The first day of the conference ended with a banquet at which Chapter President J. G. Risney presided. Henry Pildner, Cleveland, spoke on *"Business and Industry in an Atomic Age."*

The third series of group meetings was held the morning of the second day. At the steel session, William T. Bean, Jr., Industrial Electronics, Inc., Detroit, gave his views on *"Good Casting Design on Purpose, or What is Product Development?"* He defined product development as sales promotion of quality products and said it required trained men and adequate testing facilities.

J. McBroom, Stainless Foundry &

Engineering Co., Milwaukee, and R. Koch, Wehr Steel Co., West Allis, were chairman and co-chairman.

Frank Kulka, Motor Castings Co., Milwaukee, introduced P. C. Rosenthal of the University of Wisconsin, at the gray iron session. Prof. Rosenthal reviewed latest work on measurement of fluiding of gray iron and displayed a chart which could be used to indicate the pouring temperature required for a given fluidity or to indicate indirectly the composition if the pouring temperature and fluidity were known.

At the morning malleable session, Richard Herold, Borden Co., New York, stated that shell molding is a supplement to other types of molding and is not meant to replace them. He pointed out that shell mold castings have replaced forgings and weldments in the small castings field. Long production runs and jobs which normally require considerable machining are two fields for use of shell molding, he said.

Chairman and co-chairman of the shell molding session were F. Katzenski, International Harvester Co., Waukesha, and S. Pohl, Federal Malleable, Milwaukee.

Better gating design

Walter Bonsack, Christainsen Corp., Chicago, presented the latest sound-color motion picture, *"Effect of Gating Design on Casting Quality,"* reporting on A.F.S.-sponsored research in flow of metals. The picture showed the advantage of a sump at the bottom of a tapered, round sprue in minimizing turbulence and cope surface defects in aluminum alloy castings.

L. Oertel, Racine Aluminum & Brass Fdry., Racine, and C. Van Buren, Allis-Chalmers Mfg. Co., Milwaukee, were co-chairmen.

R. G. Greiner, Allis-Chalmers Mfg. Co., spoke on *"Industry Looks at Apprenticeship Training"* at the third pattern session. He said management should be interested in apprentice training because it: (1) develops skilled craftsmen; (2) provides a source of supervisory personnel; (3) improves product quality; and (4) assures production of high quality goods. Labor should be interested in apprentice training, he explained, because it provides: (1) an opportunity to learn a skilled trade; (2) greater job opportunities; (3) greater security; (4) opportunity for self-advancement; and (5) a chance to serve the community.

Chairman and co-chairman of the pattern meeting were N. J. Anderes, Belle City Malleable Iron Co., Racine, and A. M. Fischer, Chas. Jurack Pattern Co., Milwaukee.

At luncheon the second day, P. C. Fuerst, Falk Corp., Milwaukee, presided and introduced the two speakers, Herbert F. Scobie, editor, AMERICAN FOUNDRYMAN, Chicago, and George K. Dreher, Foundry Educational Foundation, Cleveland. Mr. Scobie briefly outlined the growth of AMERICAN FOUNDRYMAN from its start in July 1938 to its present status as a leading technical publication. He showed how "The Foundrymen's *Own* Magazine" serves the industry and provides a link with leaders in foundry technology from all over the world.

Mr. Dreher reviewed the first five years of the Foundry Educational Foundation. Under FEF influence, he pointed out, the industry is now provided with a growing source of foundry-minded young engineers interested in a foundry career.

The final round of technical meetings was held the afternoon of the second day. At the final steel session, Duane Bosma, Bucyrus-Erie Co., South Milwaukee, started his discussion of *"Material Handling in the Cleaning Room"* by stating that production lines should be set up around the slowest movement of the product to prevent any tie-up of material. He described the use of three annealing cars—one in the furnace, one being loaded, one being unloaded—to avoid lost time in heat treating.

R. Munson, Maynard Electric Steel Casting Co., Milwaukee, and W. Johnson, were chairman and co-chairman of the final steel session.

T. E. Barlow, Eastern Clay Products Dept., International Minerals & Chemical Corp., Chicago, spoke on *"Casting Defects as Related to Sand Practice"* at the concluding gray iron meeting. L. Woehlke, Grede Foundry Co., Milwaukee, and E. Zick, J. E. Gilson Co., Port Washington, were chairman and co-chairman.

Mr. Barlow pointed out that sand testing alone is not sand control although testing is necessary for good control. He discussed casting defects which can arise when sand properties deviate to either extreme from the optimum.

"Principles of Control of Chemistry and Related Properties in Malleable Irons" was the topic of the final malleable session. Prof. R. W. Heine, University of Wisconsin, was speaker; co-chairmen were R. Schaper, Appleton Electric Co., South Milwaukee, and B. Gapinski, Milwaukee Malleable & Gray Iron Co.

At the final non-ferrous session, Messrs. Halliwell, Anselman, and Van Buren made up an "Information Please" panel. L. J. Andres, Lawran Foundry Co., Milwaukee, and O. Sadofsky, Kenosha Brass & Aluminum Fdry. Co., Kenosha, were co-chairmen.

James Mathias, Accurate Match Plate Co., Chicago, rounded out the pattern program with a talk on *"New Developments in Pattern Practice."* Session chairman was W. Stokes, Waukesha Foundry Co., Waukesha, and co-chairman was L. Olson, Staubel & Olson Pattern Co., Racine. Mr. Mathias discussed the making of pressure cast brass cope and drag equipment, and the use of expanding plasters and rubber compounds to reduce pattern costs when duplicating.

Conference workers

The 1953 Wisconsin Regional Foundry Conference was planned under the chairmanship of A. F. Pfeiffer, Allis-Chalmers Mfg. Co. Co-chairman was R. V. Osborne, Lakeside Malleable Casting Co.; associate chairmen were G. J. Barker and E. R. Shorey of the University of Wisconsin.

Program chairman was P. C. Fuerst, Falk Corp. Assisting him were the following group program chairmen and co-chairmen: Gray Iron—C. W. Schwenn, Brillion Iron Works, Inc., and D. R. Hutchinson, Nash-Kelvinator Corp.; Malleable—R. N. Schaper, Wisconsin Appleton Co., and F. E. Katzenski, International Harvester Co.; Steel—W. Punko, Wehr Steel Co., and J. K. McBroom, Staniless Foundry & Engineering Co.; Non-ferrous—L. J. Andres, Lawran Foundry Co., and C. Van Buren, Allis-Chalmers Mfg. Co.; Pattern—J. R. Anderes, Belle City Malleable Iron Co., and R. J. Christensen, Wisconsin Pattern Works, Inc.

L. J. Gratz, G & O Pattern Works, was conference treasurer. Ticket chairman was E. C. Meagher, Federal Foundry Supply Co.; handling ticket sales was S. E. Shaver, Archer-Daniels-Midland Co. Arrangements were under: H. O. Boehm, Allis-Chalmers Mfg. Co.; F. M. Jacobs, Standard Brass Works; Martin Harder, Lakeside Malleable Casting Co.; and H. W. Schwengel, Modern Equipment Co. D. M. Gerlinger, Walter Gerlinger Inc., was publicity chairman.

California chapters join in first regional conference

CLAYTON D. RUSSELL / *Phoenix Iron Works, Oakland, Calif.*

■ The first A.F.S. Regional Foundry Conference in California was staged at the Hotel Claremont, Berkeley, February 6 and 7 by the Northern and Southern California Chapters. Host chapter for the two-day meeting, attended by 380 registrants, was Northern California.

The conference was opened by General Chairman Andrew M. Ondreyco, General Metals Corp., Oakland, at the management luncheon February 6. Principal speaker was A.F.S. Vice-President Collins L. Carter, Albion Malleable Iron Co., Albion, Mich., who outlined Society activities and told why he, as a representative of management, participated so actively in A.F.S. and other foundry organizations. Chairman and vice-chairman, respectively, at the luncheon meeting were S. D. Russell, Phoenix Iron Works, Oakland, and Wm. S. Laidley, Vulcan Steel Foundry Co., Oakland.

Mr. Carter explained that A.F.S. is a technical society, not a trade association, with approximately 11,000 members in 33 countries. He told how the work of the organization is carried on by over 100 technical committees operating in every field of foundry practice and metallurgy.

Suggests committee service

As management—occupied with such problems as financing, labor, and sales—feels the need for delegation of responsiblility for production to others, recognition of A.F.S. as a training ground and source of information on foundry practice increases, said Mr. Carter. He cited committee service as an excellent means of exchanging experiences and ideas with other technical men, and pointed to the more than 60 publications of the Society which help foundrymen solve their production problems.

He outlined chapter activities, listed the seven Society-sponsored research programs, and referred to recognition of AMERICAN FOUNDRYMAN as a source of authentic, unbiased information. In describing the Safety & Hygiene & Air Pollution Program which A.F.S. carries on for the industry, Mr. Carter stressed the importance of the work to management and the need for foundries to be good neighbors in industrial communities.

John Bermingham, E. F. Houghton & Co., speaking at California Conference dinner.

Costing was the subject of the first technical session which featured Earl Paltenghi, H. C. Macaulay Foundry Co., Berkeley, as speaker. Ralph C. Noah, San Francisco Iron Foundry, was session chairman; vice-chairman was Albert Sanchez, Vulcan Foundry.

It is not necessary for a foundry to have an elaborate cost system, Mr. Paltenghi said, but the more refinements that can be made to a simplified system, the more accurate the cost determination will be. He traced the history of foundry cost methods on the West Coast and illustrated calculation of costs for a number of hypothetical cases. These examples showed the superiority of a cost system which provides for accurate determination of costs in the various departments over the outmoded mechanic-hour system. The latter incorrectly lumps molding and core-making time together.

At the conference dinner, George W. Stewart, East Bay Brass Foundry, Richmond, presided. He presented the seven conference speakers with bronze book ends as a token of appreciation from the chapter, following brief remarks by Conference Chairman Ondreyco, Technical Section Chairman Wm. S. Gibbons, Ridge Foundry San Leandro, and Arrangements Chairman John Bermingham, E. F. Houghton Co., San Francisco. Columbia-Geneva Div., U. S. Steel Co., played host to conference attendants prior to dinner.

Place for shell molding

The evening technical session was devoted to shell molding with A. L. Goodreau, American Brass & Aluminum Foundry, Los Angeles, as speaker. A. B. Castagnola, A.B.C. Pattern Works, Oakland, and Donald C. Caudron, Pacific Brass Foundry, San Francisco, were chairman and vice-chairman of the session.

Shell molding is going to bring back to the casting industry many items which have been fabricated or forged, predicted Mr. Goodreau in presenting a paper he prepared with Edwin F. Keys, also of American

Sam F. Carter

Harry W. Dietert

Harold R. Wolfer

Brass & Aluminum. While some castings being produced by other methods will be made in shells, there is not the flexibility in shell molding that there is in green sand molding. Thus the jobbing shop will always have a place in the industry, Mr. Goodreau is firmly convinced.

Four shells a minute

Mr. Goodreau described a machine which turns out a shell every 15 to 18 seconds. He pointed out that certain Nevada sands are ideal for shell molding. A varnish-like finish on a shell, due to excess resin, does not mean freedom from penetration, he warned. Ordinary cores can be used in shell molds, the speaker declared, but must be precise and never larger than the print, else finning will result.

In describing various ways of holding shells together during pouring, Goodreau outlined a procedure for backing shells with a cheap mixture of sand and binder that sets in 30 minutes at 200 F, collapses readily, and can be reused with an addition of only one-fourth of the original binder content. Insulating properties of the shell permit running castings thinner than in usual sand practice, and gates and risers can be markedly reduced thus increasing yield, he said.

Gating and risering

The second day's program started with a discussion of the principles of gating and risering of steel castings by Arnold K. Steger, Hanford Foundry, San Bernardino. Chairman of the session was John A. Watson, General Metals Corp., Oakland; vice-chairman was Richard C. Nelson, George Bros., Grass Valley.

Mr. Steger illustrated his talk with slides showing how gating and risering principles are put to work at Hanford Foundry.

At the second morning session, Sam F. Carter, American Cast Iron Pipe Co., Birmingham, Ala., spoke on the basic-lined cupola, comparing it with the customary acid-lined furnace, and citing operating costs, present day applications, and future possibilities. Norman E. Schlegel, Waterman Industries, Inc., was chairman. Robert B. Fisher, Vulcan Foundry Co., Oakland, was vice-chairman.

Both sulphur and phosphorus can be removed in the basic cupola, Mr. Carter said, but not both by the same practice with good efficiency. Dephosphorization requires conditions to be basic and oxidizing while basic and reducing conditions promote desulphurization. The latter, he pointed out, are more in line with good cupola performance and the high temperature metal ordinarily desired.

All basic lining materials he experimented with, Mr. Carter declared, were equal to or better in performance than clay refractories, but considerably higher in cost. He described a blown dolomite patching technique that gave best overall cost. The cost of a basic lining can only be justified on the basis of greater savings in the metal charge or improved casting quality, he stated, and suggested that extensive application of water cooling might reduce refractory costs.

An advantage of major interest cited by Carter is the ability of the foundryman to use larger proportions of cast scrap, steel and/or poor coke with economic or availability advantages. The foundry no longer needs to compromise with the traditional chemical limitations of the acid cupola, he said. By choice of slag composition, almost any desired metal chemistry can be obtained from a wide variety of metal sources.

After a buffet luncheon, two more technical sessions were held. At the first, Harold R. Wolfer, Puget Sound Naval Shipyard, Bremerton, Wash., described the application of mineral perlite in mold making. He was introduced by Maurice C. Sandes, Mare Island Navy Yard, Vallejo; vice-chairman of the session was Richard D. Genger, Pacific Steel Casting Co., Berkeley.

Mr. Wolfer told how riser collars can be made from perlite, bentonite, powdered asbestos, and water using the customary techniques for mixing, shaping, and baking cores. These increase riser efficiency, as does perlite or old insulating collar material sprinkled on the riser top, said Mr. Wolfer. Use of perlite in facing sand promotes freedom from buckles and scabs, he added. Perlite has been used successfully in casting steel, gray iron, and copper-base alloys.

Water and sand properties

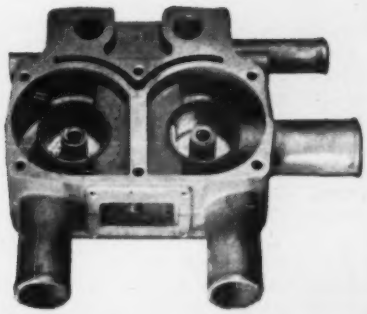
Final conference speaker was Harry W. Dietert, Harry W. Dietert Co., Detroit, who spoke on properties and applications of foundry sands. Session chairman was Donald L. Mason, Superior Electrocast Foundry Co.

Mr. Dietert outlined the effect of water on sand properties and discussed proper tempering of sands. He emphasized the importance of controlling deformation to avoid excessive change in mold volume after the metal freezes in the ingate. Deformation above 0.025 in. per in. for green sand molds is conducive to scabs, he said. For dry sand molds he recommended keeping deformation below 0.032 in. per in.

At the conclusion of Mr. Dietert's presentation, Technical Chairman Gibbons turned the conference over to General Chairman Ondreyco for closing remarks.

Committee chairmen

Conference committee chairmen, in addition to Messrs. Ondreyco, Gibbons, and Bermingham, were: Southern California Chapter—Kenneth L. Clark, International Nickel Co., Los Angeles; Publicity—Clayton D. Russell, Phoenix Iron Works, Oakland; Reception—John R. Russo, Russo Foundry Equipment Co., Oakland; Registration and Finance—Davis Taylor, American Wheelabrator & Equipment Corp., San Francisco; Housing—Charles R. Marshall, Industrial Foundry Supply Co., San Francisco; Tickets—J. M. Snyder, Joseph Musto Sons-Keenan Co., Oakland; Attendance—Dan Henry, Federated Metals Div., American Smelting & Refining Co., San Francisco; Management Luncheon—Wm. S. Laidley, Vulcan Steel Foundry Co., Oakland; Refreshments—James W. Rimmer, Columbia-Geneva Div., U. S. Steel Co.; Dinner—Wm. R. Skinner, Pacific Graphite Co.; Buffet Lunch—Burt P. Christensen, Laclede-Christy Co., San Francisco.



This heart must pulse or the Plane's in trouble—

Radiograph of de-icer pump casting

so it's checked by RADIOGRAPHY

ICE can down a plane as sure as flak. So it's kept from wing-edge and prop by the throbs of this pulsating heart.

Easy to see the importance of this tiny unit—and why its castings must be sound. To make certain, each part is x-rayed. This way weakness cannot lurk in a hidden flaw.

What's more—a part so finely finished calls for careful machining, which would be wasted if x-rays did not first reject any unsatisfactory castings.

It's another example of why more and more suppliers of castings use radiography. It speeds the establishment of proper casting technics and lets you be sure only sound castings are delivered.

If you'd like to know how radiography can improve your operations, get in touch with your x-ray dealer. Or, if you like, write us for a free copy of "Radiography as a Foundry Tool."

EASTMAN KODAK COMPANY
X-ray Division, Rochester 4, N. Y.

Radiography...
another important function of photography

Kodak
TRADE-MARK

news of technical committees

Steel research

Careful plans for continuing the research project of the A.F.S. Steel Division were developed at the Research Committee meeting held in Chicago, January 16. The project will now be carried on cooperatively at the following foundries:

American Steel Foundries, Inc., East Chicago, Ind.

Bucyrus-Erie Co., So. Milwaukee.

Burnside Steel Foundry Co., Chicago.

Crane Co., Chicago.

Harrison Steel Castings Co., Attica, Ind.

Minneapolis Electric Steel Castings Co., Minneapolis.

Sivyer Steel Casting Co., Milwaukee.

The committee is attempting to evaluate core sand mixtures and their relation to hot tearing, and each of the foundries involved will adhere to a single sand mixture so as to establish reproducibility of test results. The data from each foundry will include moisture content and weight of baked cores, tests to be run on each of three different sand mixes in order to obtain a range of hot tears. Test cylinders will be shot blasted and examined by magnetic powder inspection, all results then being evaluated by the committee.

Safety

Revision of the A.F.S. manual on *Recommended Good Safety Practices for the Protection of Workers in Foundries* was the main subject at a meeting of the Safety Committee held in Chicago, February 12. The committee also agreed to petition the National Safety Council, urging the setting up of a separate section for the foundry industry.

Shell molding

A.F.S. Sand Division Committee on Shell Molding Material Testing met in Pittsburgh, December 5, to continue the job of exploring the possibilities of developing tentative standard testing procedures for shell molding materials. A tentative reference sand was approved by the committee, to be known and marked as "Tentative 8-N Reference Sand."

The committee outlined a tentative procedure for a tensile test to be used by its members. Next job is to select a test, then to determine size and shape of test specimens and how to make it, mold temperature, method of dumping and strike-off, curing cycle, preparation of mixture material, and number of specimens to be tested.

Dust control

The 1953 Convention program for the Dust Control and Ventilation Committee was finalized at a meeting of the group held in Chicago, January 13. Several papers will be presented. Discussion leaders were selected and all plans made for this first separate program on foundry dust control and ventilation procedures.

Considerable progress has been made in development of a manual of *Dust Control and Ventilation*, which is intended for publication within the next six months. The committee has developed a check list of causes of internal and external air pollution for the benefit of foundry operators who do not have experienced personnel available for these activities. The list should make it possible for every foundry operator to check the degree of emissions in order to avoid nuisance hazards. The committee also is studying a radiation method for testing ventilating systems.

Air pollution

Main subject at the meeting of the Air Pollution Committee in Chicago, December 10, concerned progress in the air pollution manual which A.F.S. is now developing through the Safety & Hygiene & Air Pollution program. An individual plant survey is being developed to determine foundry locations where air pollution control methods may best be applied in meeting local ordinances. Such data should prove of great value to operators of many small foundries not in a position to make their own determinations.

Control of cupola emissions, being given great attention by the committee, concerns variations in type and size of melting units as well as operating practices. It is believed that the complete cycle of operation must be considered when gathering sampling data or designing control equipment, and that the manual now being developed must recommend operating practices as a part of emissions control. A check list of internal and external air pollution sources is also being developed in conjunction with the Dust and Ventilation Committee. This list is being forwarded to a committee of the Foundry Equipment Manufacturers Association concerned, as well as to others.

Field tests, inspections and service observations are planned by the committee in order to obtain complete factual and practical data. It is recognized that any manual produced by the Society cannot meet all operating conditions in every section of the country, nor meet all present or future local ordinance requirements. The urgent need today is for the development of accurate and practical engineering information which can be applied by any foundry to its individual air pollution problem.

The committee, through AMERICAN FOUNDRYMAN, has requested that any foundry which has developed workable means of air pollution control would perform a service to the industry by communicating with the Director of the Safety & Hygiene & Air Pollution Program at the A.F.S. National Office, Chicago.

Gray iron research

The Research Committee of the Gray Iron Division investigating gating and risering met in New York, February 3, to review a report of work to date at Massachusetts Institute of Technology, and to outline future plans. The committee approved a recommendation to explore gating effects and particularly thermal gradients in simple castings.

Future plans involve an exploration of hypo-eutectic cast iron, eutectic cast iron, pouring temperature effects, and other related variables in the composition, temperature and cooling rate system. A report of this research committee will be presented at the 1953 Convention in Chicago.

Sand definitions

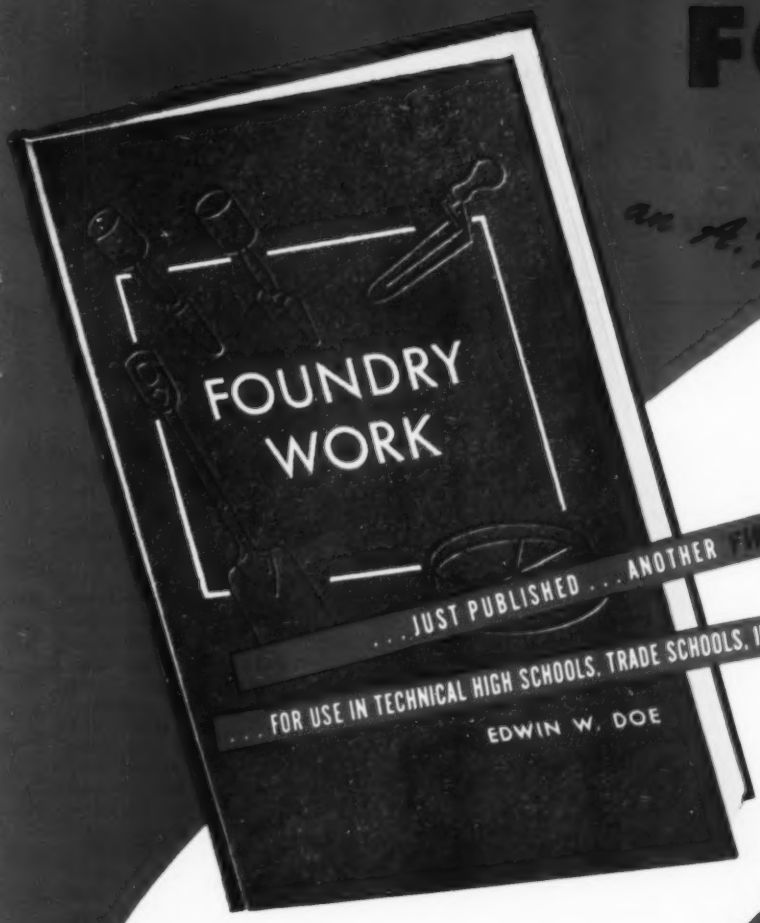
In addition to the A.F.S. publication *Foundry Terminology*, which now is nearing completion, the Sand Nomenclature Committee of the A.F.S. Sand Division is developing its own definitions of terms used in foundry sand practice. At a meeting held February 13, assignments were made for completing the job.

continued on page 108

FOUNDRY WORK

an A.F.S. Endorsed

FOUNDRY TEXTBOOK



. . . JUST PUBLISHED . . . ANOTHER FIRST FOR A.F.S.

. . . FOR USE IN TECHNICAL HIGH SCHOOLS, TRADE SCHOOLS, INDOCTRINATION AND APPRENTICE TRAINING PROGRAMS

EDWIN W. DOE

The first authentic high-school foundry textbook ever published. Prepared by Edwin W. Doe of Brooklyn Technical High School, Brooklyn, N. Y., under direction of the Educational Division of American Foundrymen's Society, FOUNDRY WORK is a compact, practical approach to foundry work and the Foundry Industry, including the tools, equipment, processes, patterns and other basic elements of the sand casting of metals.

The text is specially designed for rapid, progressive teaching of a fascinating, basic occupation that embodies both art and science. It tells why "Every product begins in the Foundry." It includes a series of simple molding problems for shop practice. An essential background text for an interesting, well-paying, man's job.

Contents . . .

1 THE FOUNDRY INDUSTRY—Early history. Modern foundries. Value of foundry products to modern industry.

2 FUNDAMENTAL FOUNDRY PROCESSES—Molding. Coremaking. Melting. Pouring. Cleaning and finishing castings.

3 FOUNDRY TOOLS AND EQUIPMENT—Hand tools. Mechanical tools. Flasks.

4 PATTERNS—Split-back patterns. Patterns with irregular parting. Split patterns. Gated patterns. Matchplate patterns.

5 SAND MOLDING—Green sand molding. Exercises. Floor molding. Exercises. Machine molding. Dry sand molding. Loam molding. Centrifugal casting.

6 BAKED SAND CORES—Hand coremaking. Exercises. Machine-made cores.

7 MELTING AND POURING METALS AND ALLOYS—Gray iron; Cupola furnaces; Electric furnaces; Air furnaces. Steel; Open hearth furnace; Converter; Electric furnaces. Nonferrous Metals; Crucible furnace; Reverberatory furnace; Electric furnaces.

8 CLEANING AND FINISHING CASTINGS—Hand cleaning. Mechanical cleaning; Tumbling barrel; Sand blasting; Airless blast cleaning. Chemical cleaning. Auxiliary tools used in finishing. Inspection. Heat treatment of castings.

9 OCCUPATIONAL ADVANCEMENT IN THE FOUNDRY—Glossary of foundry terms.

Case Bound Size 6 x 9, contains 109 pages, over 100 illustrations. Published by John Wiley & Sons Co., New York, for A.F.S. Price $1.76

AMERICAN FOUNDRYMEN'S SOCIETY
616 South Michigan Avenue
Chicago 5, Illinois

Please send me promptly _____ copies of "FOUNDRY WORK" by Edwin W. Doe.

I enclose $ _____ Cash ☐ Money Order ☐ Check ☐ to cover.
Please send invoice

Name _____

Company _____

Address _____

City _____ P. O. Zone _____ State _____

Postage paid by A.F.S. when remittance accompanies order

MIT student chapter members operate experimental foundry

In addition to holding about eight dinner and technical meetings a year in the foundry laboratory, the MIT Student Chapter has as an important activity the Experimental Foundry. The students operate the foundry all day on Saturdays, planning their own experiments and projects and doing all the work.

RUSSELL A. CHIHOSKI / *Technical Secretary, MIT Student Chapter*

■ The most vital function of the MIT Chapter is the Experimental Foundry. Saturday mornings a group of ten to 15 students, most of whom are A.F.S. members, meet in the MIT foundry and conduct the program planned for the day. The Experimental Foundry has a separate roster but its accomplishments are entered as A.F.S. achievements.

Student members plan program

What metal will be poured and how much, what experiments will be made, whether to use cupola, induction, gas, or arc furnaces, the whole program is laid out by A.F.S. members. Anyone in the school is invited to become a member of the Experimental Foundry. The only requirement is that these members must help run the foundry and help clean up in the afternoon. Their profit is the castings they make there. The bookends, plaques, castings for inventions, and sundry objects are valuable items to the maker. The cost of the metal is insignificant for the help received from a good crew, and more than a few students have taken an interest in the foundry game after attending Saturday runs.

This past semester the cupolas have not been operating so only a little gray iron has been run, but much has been made of aluminum alloys, bronzes, and iron alloys. In the last run ductile iron castings were produced.

The schedule usually has a run close to normal industrial procedure, but with the changing of one or several variables which may be anything from cupola charge or metal temperature to risering and sand composition. The reactions and the change in results are carefully noted. Often in some corner several men work on their own scheme, testing some new ideas with the day's melt. Sometimes the whole day is an experiment such as the producing of the ductile iron.

After most of the molding is done and the metal is being melted, everyone is called to a corner where the preparations already made are discussed, results are calculated and predicted, and sometimes an instructor or graduate is induced to come up and lecture and talk over phenomena related to the day's work. The discussion and argument that follows the shakeout supplements this and offers in part an explanation of the results, but during the year several bulletins are written up and distributed discussing the runs and giving conclusions and suggestions.

After the talk the metal is poured and left while everyone goes to the kitchen for hot lunch served up at cost by some of the boys. After shakeout and cleanup is finished, usually before 2 p.m., everyone's time is his own and he may finish his castings or hang around for a bull session.

Once each semester an A.F.S. and Experimental Foundry membership drive is conducted. The same advertising scheme used for regular meetings is followed (posters, leaflets, short talks before classes) but on a bigger scale with a bigger climax in a demonstration run on Saturday. This is followed by a dinner where students may meet and talk with foundry people and later hear a good deal about the business from speakers in the casting industry.

Sold on foundry industry

The A.F.S. members at MIT are sold on the foundry business. Their friends and contacts know this well and admit the budding foundrymen have had well rounded experience and know more about their industry than most of the other student engineers. They have corresponded directly or through association with the Foundry Educational Foundation with companies all over the country for summer foundry work. They have met and talked with many foundrymen who attended their dinners and whose dinners they attend.

Left. . MIT Experimental Foundry group hears lecturer outline technology of nodular iron production. Center. . Ramming experimental molds in one of the molding areas. Right. . Magnesium fire flares as iron is poured from high frequency induction furnace into receiving ladle.

for assured high efficiency in making a casting...

use PENOLYN CORE OIL

Penolyn Core Oil offers these 10 Important Features for full efficiency

- Uniformity
- Concentrated form
- No obnoxious odor
- No seepage
- No crusting or green mix
- Clean working
- Wide temperature range
- Polymerized formulation
- Minimum gas
- Ample collapsibility

For maximum foundry efficiency—be sure to specify Penolyn Core Oil. There is a grade of Penolyn for every type of casting, to meet the most exacting requirements of every conceivable Foundry and Core Room Practice.

PENOLA OIL COMPANY

Penola

NEW YORK
DETROIT
CHICAGO

For expert technical assistance—be sure to call the nearest Penola Office for any technical data or assistance you may need regarding your casting operations.

foundry tradenews

Cleco Div., Reed Roller Bit Co., Houston, Texas, has announced appointment of the following distributors for Cleco products in their areas: General Equipment & Machine Co., South Bend.; A & I Supply Co., Charleston, W. Va.; Lyons Machine Co., Little Rock, Ark.; and Equitable Equipment Co., Inc., New Orleans.

American Steel Foundries is adding four heat treating buildings to its armor plate plant in East Chicago, which operates under defense contract. This plant was built for American Steel Foundries during World War II and produces cast armor plate, turrets, etc.

The 60th anniversary of Thor Portable Power Tools is being celebrated by **Independent Pneumatic Tool Co.,** manufacturers of Thor products. From humble beginnings in a small Aurora, Ill., machine shop, the original site of which is now occupied by a block-square factory, the firm, founded in 1893, has developed into a world-wide manufacturing and sales organization cataloging over 1500 types of pneumatic and electric tools.

Apex Smelting Co., Chicago, has formed the **National Metallurgical Corp.** to construct and operate its pilot plant at Springfield, Ore., for the production of aluminum-silicon metal from clays. **American Smelting & Refining Co.,** New York, has acquired a half interest in the new corporation.

Whiting Corp., Harvey, Ill., has announced removal of its St. Louis district sales office to University City, Mo. F. P. Walsh, who heads the new office, will be assisted by Harold Schaill and Felix Machiewicz.

C. A. Goldsmith Co., has acquired the **Atlas Foundry Co.,** Irvington, N. J., which it will operate as heretofore, as a producer of gray iron and steel castings. The move makes it possible for the management now to supply a full line of both ferrous and non-ferrous castings.

The new **Harsell Engineering Co.,** Hermosa Beach, Calif., has been organized to manufacture a dust collecting system designed by T. L. Harsell Jr., head of the firm. Intended for control of dust, fume and odor especially in foundries, smelters, and in carbon black and other non-metallic industries, the system will be marketed nationally. Initially the firm will specialize in the design and production of bag houses using silicone-treated, glass fabric bags for handling high temperature gases. The system is built entirely of standard structural steel, and can be purchased as a packaged unit, or can be fabricated from drawings furnished by the company.

The new 38-page catalog of **American Car & Foundry Co.,** New York, is a foundry tour in pictures. Entitled "Artistry in Metal," the booklet starts with a diagram of a modern foundry layout as used by one ACF plant, and shows operations in the company's Huntington (W. Va.), St. Louis, and Berwick (Pa.) plants. Also illustrated are typical castings produced and the ACF machine shop, welding, and heat treating facilities.

American Wheelabrator & Equipment Corp., Mishawaka, Ind., has completed construction of a plant designed for manufacture of steel shot, a new blast cleaning abrasive produced under the company's patented process. The plant, largest of its kind in the world, is completely mechanized, and equipped with electric melting furnaces and automatically controlled heat treating equipment to assure uniformity of product.

The **Foundry Div., Eaton Manufacturing Co.,** Vassar, Mich., won the company's 1952 contest for making the greatest improvement in its safety record. Two safety contests are conducted annually among the 12 Eaton divisions. One is to determine the division having the best safety record for the year, the other, which division has shown the greatest improvement over its previous five year safety record.

Maintenance crews of **Albion Malleable Iron Co.,** Albion, Mich., worked round the clock during the Christmas holidays to install two new cupolas. The AMICO crew worked three shifts a day from the afternoon of December 24 to the early morning of January 5. While the maintenance department was dismantling the pipes and clearing the area, the melting department tore out the lining from the old cupolas and final work on the pre-installed blowers was done. The AMICO crews were assisted by the men of five contractors.

Lebanon Steel Foundry, Lebanon, Pa., producers of stainless, special alloy and carbon steel castings, have published a booklet which illustrates just what a steel foundry is. Theme of the brochure is based on a tour of Lebanon facilities. Pictures of pattern and molding functions, heading gating, heat-treating and the other steps necessary to the casting of carbon, alloy, and stainless steels are shown.

The 5th annual report of **Southwest Research Institute** chronicles the institute's accomplishments for the past five years through the application of scientific principles to the needs of industry and agriculture. The work is now carried out in five departments which specialize in various fields of scientific endeavor. Departments include chemistry and chemical engineering, engineering mechanics, fuels, lubricants and engines research, mineral technology, and physics.

Shell molding process of producing stainless alloy castings is outlined in **Solar Aircraft's** (San Diego, Calif.) new brochure. Until recently the foundry produced alloy castings exclusively for Solar use; now it is accepting orders from other industrial and aircraft firms.

American Wheelabrator & Equipment Corp., recently completed a plant at Mishawaka, Ind., designed for the manufacture of steel blast cleaning shot under the company's patented process. The plant, largest of its kind, is completely mechanized and equipped with electric melting furnaces and automatically controlled heat treating equipment (shown above).

Finders--Keepers!

When new users see how effectively Famous Cornell Cupola Flux minimizes casting rejects, they say it is a real find, and lose no time in making it a MUST in their daily production. No charge of iron will be complete without it. *Leading users today were new users years ago.*

Famous CORNELL CUPOLA FLUX

The IRON CLEANSER with over 34 years' success in casting improvement. Besides purifying molten iron it makes it hotter, more fluid, greatly reduces sulphur, and keeps slag fluid.

The castings you pour are sounder, cleaner and easier to machine.

Pre-Measured SCORED BRICK FORM saves time and labor in fluxing molten iron—and you do a more accurate job.

KEEPS CUPOLAS CLEANER, reducing maintenance cost. Drops are cleaner. Bridging over is practically eliminated. And a glazed or vitrified surface which is formed on cupola lining, reduces erosion and repairs.

WRITE FOR BULLETIN NO. 46-B

THE CUPOLA before using Famous Cornell Cupola Flux.

THE CUPOLA during the use of Famous Cornell Cupola Flux.

The Cleveland Flux Co.

1026-1040 MAIN AVENUE, N. W., CLEVELAND 13, OHIO

Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum and Ladle Fluxes – Since 1918

FAMOUS CORNELL FLUXES

Trade Mark Registered

BRASS FLUX

FAMOUS CORNELL BRASS FLUX cleanses molten brass even when the dirtiest brass turnings or sweepings are used. You pour clean, strong castings which withstand high pressure tests and take a beautiful finish. The use of this flux saves considerable tin and other metals, and keeps crucible and furnace linings cleaner, adds to lining life and reduces maintenance.

ALUMINUM FLUX

FAMOUS CORNELL ALUMINUM FLUX cleanses molten aluminum so that you pour clean, tough castings. No spongy or porous spots even when more scrap is used. Thinner yet stronger sections can be poured. Castings take a higher polish. Exclusive formula reduces obnoxious gases, improves working conditions. Dross contains no metal after this flux is used.

Knight Foundry Services include:

Foundry engineering

Survey of facilities

Foundry design

Construction

Mechanization

Modernization

Materials Handling

Production Control

Cost Control

Industrial engineering

Wage incentives

Organization

Management

Complete

Modernization Program

Amortized in *Less* than a year through savings in unit labor costs

A complete operational analysis of this plant was made by experienced Knight engineers. Their survey proved that modernization, rather than complete mechanization, would increase production per man hour, establish an equitable rate structure, and eliminate overtime which amounted to 5% of existing labor costs.

The modernization program, based on the relocation of equipment, motorization, and improved methods, has been carried out. In addition to achieving the objectives above, it has also resulted in improved quality control which reduced scrap waste by 50%.

This plant is a good place to work.

Whatever your industrial problem, you will benefit by the experience of Knight engineers. For prompt attention, call our Chicago or New York office.

EVIDENCE OF EXPERIENCE

Lester B. Knight & Associates, Inc.

Management, Industrial and Architectural Engineers

MEMBER OF THE ASSOCIATION OF CONSULTING MANAGEMENT ENGINEERS, INC.

600 W. Jackson Blvd., Chicago 6

Eastern Office—Lester B. Knight & Associates, 50 Church St., New York City 7

abstracts

Abstracts below have been prepared by Research Information Service of The John Crerar Library, 86 East Randolph Street, Chicago 1, Ill. For photoduplication of any of the articles abstracted below, write to Photoduplication Service at the above address, identifying articles fully, and enclosing check for prepayment. Each article of ten pages or fraction thereof is $1.40, including postage. Articles over ten pages are an additional $1.40 for each ten pages. A substantial saving is offered by purchase of coupons in advance. For a brochure describing Crerar's library research service, write to Research Information Service.

Casting cleaning

A272.."Fettling of Mass Production Castings," R. P. Henricks, *Engineer and Foundryman*, Vol. 17, No. 2, June 1952, pp. 47, 49, 51, 53, 55.

Fettling and cleaning operations are often neglected in otherwise well managed foundries. By proper attention to these details, the appearance of the product will be improved and the customer will be better pleased, since the first impression of the product appearance is indicative of quality to the customer. Proper use and care of equipment such as grinders, chippers and airless blast equipment are discussed in detail.

Shrinkage and composition

A273.."Relationship Between the Equilibrium Diagram and the Solidification Shrinkage," André Tatur, *Fonderie*, No. 75, April 1952, pp. 2884-2897. (In French)

The amount of solidification shrinkage was measured for Sn, Sb, Cu, Pb, Fe, Al, Ni, Zn, Cd, and Bi, as well as for Pb-Sn, Zn-Cd, and Mg-Zn alloys, by using die-cast cones. The relationships between both the amount and the shape of the shrinkage, and the corresponding position of the material on the equilibrium diagram were observed. The main differences were found to be related to the contrasting behavior of eutectics and of substances solidifying with a certain temperature range.

Heat treating furnace

A274.."Recent Tempering Furnace Techniques," K. Borchart, *Giesserei*, Vol. 39, No. 8, April 17, 1952, pp. 171-179. (In German)

The use of gas in the tempering and the annealing of black-heart malleable cast iron without the use of the pot requires entirely new furnace constructions, among which the elevator-furnace is most advantageous. Because of the necessity of an absolutely perfect impermeability to gas, furnaces with gaseous atmospheres have to be heated exclusively with electricity or, in the case of the use of gas, with blast gun heating devices.

Shell molding

A275.."Job Foundry Tackles Shell Mold Production," G. Palmer Derby, *Iron Age*, Vol. 169, No. 20, May 15, 1952, pp. 109-113.

The Lynchburg Foundry Co. has been successfully producing gray and ductile

Bronze tablet cast by O'Hare's Foundry Co. St. Louis, commemorates students of the University of Missouri who gave their lives for their country in World War II. The company, headed by Francis T. O'Hare, was formerly known as Central Brass & Aluminum Foundry Co., also located in St. Louis.

iron castings by shell molding on a six months trial basis. The work is carried out on a specially designed turntable capable of supporting four patterns. Two foundrymen who were formerly jolt-squeeze and snap-flask operators have been found to be well qualified operators after a short period of training. At present, the foundry is working toward a goal of 70 to 75 tons of shell molded castings a day.

Measure shrinkage of steel

A276.."Electrical Cone Heating of Heavy Steel Castings," W. Rietzscher, *Giesserei*, vol. 39, no. 21, October 16, 1952, pp. 553-558. (In German).

The quantity of shrinkage in steel castings can be determined from the observation of the behavior of the cavities in the specimen when undergoing electrical heating. The rate of solidification of such castings can also be so determined. The cone sizes and the electrical energies required in such a procedure are calculated.

Molds for titanium

A277.."Titanium Casting Research Tests Shell Molded Refractories." J. G. Kura, *Iron Age*, vol. 170, no. 18, October 30, 1952, pp. 88-92.

Research devoted to a study of refractory materials suitable for titanium casting molds included testing by casting melts prepared in an inert atmosphere and investigation of surface finish, amount of pinholing, and contamination depth. Many materials gave better surface finish than washed silica molds but none gave less pinholing. Refractories are not suitable for crucibles for molten titanium but might serve as molds because of the lower temperature. Permanent type molds were emphasized in the research.

Titanium chemical activity has not favored casting by conventional foundry methods, but the problem of finding suitable molding materials nears solution. Many tables, diagrams and photomicrographs are included.

Shell molding machine

A278.."Developed by Students: Low Cost Shell Molding Machine for the Small Jobbing Foundry," *Modern Metals*, vol. 8, no. 10, November, 1952, pp. 58-59.

Stanford University's Industrial Laboratory has developed a foundry shell molding machine that is said to provide the "middle ground" between manual operations and expensive automatic machines, and be therefore suitable for small jobbing foundries.

The machine is constructed of angle iron, channels, bar stock and sheet metal. It consists basically of two parallel rails upon which a pattern carriage rides between a heating and curving oven and the mold-making dump box. An oven is located at each end of the rails so that two shells can be in process at one time.

he pattern is mounted on a frame from which extend two pins along its longer axis, the pins resting in sockets on the carriage. The pattern is preheated in the oven, and is kept at an operating temperature of 450 F.

In operation, the heated pattern moves from the oven to a dump box containing the mold mixture, being rotated 180 degrees enroute. An air cylinder raises the box, pattern and frame. Clamps attach the pattern to the top of the box. The combination is inverted and the thermoplastic resin and sand mixture hits the heated pattern. After the inversion period the dump box is righted, the clamps released and the dump box lowered, leaving the pattern frame again in the carriage sockets.

During the return of the unit to the oven for curing, the inverted pattern and frame are righted by a rack and pinion. After a curing period of 35 to 45 seconds, the carriage moves to a position just outside the oven where the new shell is stripped from the pattern ready for use.

With two ovens, a second pattern can go through the stripping and dumping cycles while the first is curing, thus doubling the production rate. With this arrangement, one operator can operate two machines.

book reviews

Materials handling handbook

Handbook of Manual Materials Handling Equipment . . 48 pp. Illustrated. Compiled and written by the Market and Product Research Committee of the Caster and Floor Truck Manufacturers' Association, 27 E. Monroe St., Chicago, Ill. $1.00. (1953)

Included in this manual is detailed information on industrial wheels (pneumatic, tire-tread, solid rim, spoke, bearing, and other types) . . . caster equipment . . . two-wheel hand trucks . . . industrial platform trucks . . . pallets and skids.

Electric steel proceedings

Electric Furnace Steel Proceedings . . 302 pp. Illustrated with photographs, charts and tables. Published by the American Institute of Mining and Metallurgical Engineers, 29 W. 39th St., New York 18, N. Y. (1952)

These Proceedings of the Ninth Conference of the Electric Furnace Steel Committee, Iron and Steel Division AIME, contain a complete record of all papers and discussions presented at the conference in Pittsburgh, Dec. 6-7-8, 1951.

The first session was on the subject of availability and conservation of raw materials. Following this was a symposium on special features in electric furnace practice. Other sessions were on stainless steel, bottom maintenance and furnace design, acid vs basic practice for castings, refractories, and residual elements.

Corrosion testing

Corrosion Testing Procedures . . F. A. Champion. 369 pp. Illustrated. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York. (1952)

An investigator concerned with corrosion of metals in service and development of metal of adequate corrosion resistance will find the following topics covered in this book: choice and preparation of metal and corrosive; exposure to environment in laboratory, field or service tests; cleaning of specimens; examination for effects of corrosion; and the interpretation of results.

Metal fatigue and fracture

Fatigue and Fracture of Metals . . Edited by William M. Murray. 313 pp. Illustrated. Published by The Technology Press of The Massachusetts Institute of Technology and John Wiley & Sons, Inc., New York 16. $6.00 (1952)

This book is a collection of 14 papers on metal fatigue and fracture, presented at a conference at the Massachusetts Institute of Technology. The discussion embraced: general experience with failure of metals; the internal mechanisms probably involved in fatigue damage; the significance of various metallurgical phenomena to fatigue; the potential usefulness of different research methods to disclose more about the mechanism itself and about ways of countering it in design, and the direction of future research.

Foundry training

Training for Ironfounding . . Council of Ironfoundry Associations, Ashorne Hill, Leamington, Great Britain, 92 pp. Published by the Council. Price 3s. 6d. (1952)

This paper-backed pamphlet covers training in the following classifications: The craftsman (training the successful molder); the foundry technician (bringing more brains to the job); the foreman (making the craftsman into a supervisor) and the junior executive (training for leadership).

Among the foundry training papers represented is one on *"Film and Other Visual Aids"* . . Other subjects are: *"Recommendations on Training in Molding and Coremaking"* . . . *"Training for Foundry Management"* . . . *"Vocational Training"* . . . *"Training in Foremanship"* . . . and *"Foreign Schemes of Foundry Training."* The reports on the general discussions should also be of interest to foundrymen.

Metallurgy

Metallurgy for Engineers . . John Wulff, Howard Taylor and Amos Shaler. 624 pp. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16. $6.75 (1952)

The material in this book is designed to provide information on the metallurgical principles behind metal processing and the treatment of the processes themselves. It is written from the engineering rather than the shop viewpoint. A feature of the book is that the end of each chapter has a summary of the most important points included in the chapter . . . definition of the words, terms and concepts covered . . . a group of questions to test the reader's understanding of the material . . . and a list of references.

Approximately one fourth of the book refers directly to foundry practices, the rest being devoted to welding and working methods and related subjects. Schematic drawings are widely used to illustrate processes and equipment.

Supervision

How to Supervise People . . by Alfred M. Cooper. 254 pp. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36. $3.75 (1952)

Now in its third edition, this book covers all the typical jobs and the problems of hiring, discipline, preventing accidents, promoting teamwork, training workers, delegating authority, labor relations, etc. Newly added is a discussion of the Taft-Hartley law as it affects the supervisor and an outline of a program for employee participation in management.

Intermediate foundry text

Foundry Practice . . W. H. Salmon & E. N. Simons. 384 pp. Illustrated. Published by Pitman Publishing Corp., 2 W. 45th St., New York 19. $6.50 (1951)

This is a book designed for the intermediate student of the foundry. It is a simple, clear, and accurate text. Individual chapters cover blueprints; patterns; mold materials; sand mixing and distribution; molding and core-making; mold drying and core baking; closing and pouring the molds; cast metal; molten metal; cleaning and salvage; heat treatment; and quality control. Book is full of useful tables.

Clean air

Industrial Ventilation . . second edition. Illustrated. Published by Committee on Industrial Ventilation, P.O. Box 453, Lansing 2, Mich. $3.00 (1952)

A single source of the most recent data on this subject. The text, supplemented by over 500 illustrations, has been prepared by engineers active in the industrial field. Contents present proven methods of control.

Plant management and engineering personnel, faculty members, and students who participated in visit of FEF students to the Sharon (Pa.) plant of National Malleable & Steel Castings Co. The students were treated to an entire day in the plant including conferences with officials, observation of the various departments, and a study of company products.

A.F.S. Publications

	Publication Number	A.F.S. Members	Non-Members
Books			
Alloy Cast Irons Handbook (2nd Edition)	1	$2.75	$4.50
Analysis of Casting Defects	3	2.50	4.25
Copper-Base Alloys Foundry Practice	57	3.75	5.75
Cupola Operations Handbook	7	6.00	10.00
Development of Metal Castings Industry	8	3.00	6.00
Foundry Core Practice (2nd Edition)	38	6.50	10.00
Foundry Sand Handbook (6th Edition)	12	3.50	5.25
Foundry Work	50	1.76	1.76
Patternmaker's Manual	61	4.50	6.75
Recommended Practices for Sand Casting Aluminum & Magnesium Alloys	24	1.00	1.75
Symposia			
Foundry Dust Control	10	1.00	2.00
Malleable Foundry Sand and Core Practice	16	2.00	3.25
Sand Test Data for Production of Steel Castings	47	3.00	4.75
Symposium on Air Pollution	62	1.75	2.50
Symposium on Principles of Gating	56	4.00	5.75
Foundry cost booklets			
Classification of Foundry Cost Factors	6	1.00	2.00
Foundry Cost Methods	9	1.50	3.00
Recommended practices—safety and hygiene			
Fundamentals of Design, Construction and Maintenance of Exhaust Systems	19	3.00	5.00
Good Practices for Metal Cleaning Sanitation	20	1.25	2.25
Grinding, Polishing and Buffing Equipment Sanitation	22	.75	.75
Health Protection in Foundry Practice	59	3.00	4.50
Safety Practice for Protection of Workers in Foundries	21	1.25	2.25
Testing and Measuring Air Flow	26	1.00	2.00
Annual Transactions			
Volume 53—1945	30	4.00	15.00
Volume 54—1946	31	4.00	15.00
Volume 55—1947	32	4.00	15.00
Volume 57—1949	33	8.00	15.00
Volume 60—1952	60	8.00	15.00
Index to AFS Transactions (1930-1940)	36	1.00	2.00
Education			
Apprentice Training Standards for the Foundry Industry	29	1.00	2.00
Foundry Apprentice Course Outline	39	1.00	2.00
Guide for Foremen Training Conferences	34	1.50	2.25
A. F. S. research progress reports			
Light Metals—A Study of the Principles of Gating	54	1.00	1.50
Light Metals—Principles of Gating as Applied to Sprue-Base Design	58	.50	.75
Brass and Bronze—Melt Quality and Fracture Characteristics of 85-5-5-5	55	1.00	1.50
Gray Iron—Risering of Gray Iron Castings—Report No. 1	42	1.00	2.00
Gray Iron—Risering of Gray Iron Castings—Report No. 2	43	1.00	2.00
Malleable—Surface Hardening of Pearlitic Malleable Irons	52	.40	.60
Steel—Steel Sands at Elevated Temperatures (Tenth)	53	.40	.60
A. F. S. special publications			
Bibliography of Centrifugal Casting	35	1.50	2.25
Cupola Research Committee Reports	49	1.00	1.50
Engineering Properties of Cast Iron	46	2.25	3.50
85-5-5-5 Test Bar Design (Fourth Annual Lecture—1946)	37	1.00	2.00
Gating Terminology Chart (Discount on Quantity Lots)	14	.10	.25
Graphite Classification Chart (25 x 38 in.)	44	1.25	1.75
Pattern Standard Color Chart (Discount on Quantity Lots)	51	.10	.25
Permanent Mold Castings Bibliography	18	1.50	3.00
Statistical Quality Control for Foundries (Available January, 1953—Price to be determined)	63	—	—
Other publications			
Aluminum Foundry Process Control (SAE)	2	1.00	2.50
American Malleable Iron—a Handbook	64	4.00	4.00
Ferrous Foundry Process Control (SAE)	11	1.50	2.50
Gates and Risers for Castings (Penton Pub. Co.)	40	6.00	6.00
Non-Ferrous Melting Practice (AIME)	41	3.00	3.50

Please send books circled

AMERICAN FOUNDRYMEN'S SOCIETY
616 South Michigan Avenue, Chicago 5, Illinois

Please send the books circled below. $_____ remittance enclosed.

1 2 3 6 7 8 9 10 11 12 14 16 18 19 20 21 22
24 26 27 29 30 31 32 33 34 35 36 37 38 39 40 41 42
43 44 45 46 47 49 50 51 52 53 54 55 56 57 58 59 60
61 62 63 64

Name _____

Address _____

City _____ Zone _____ State _____

Company _____

AFS pays postage when remittance accompanies order.

quizmaster

These answers to the questions on page 40 were provided by the technical service staff of Federated Metals Div., American Smelting & Refining Co.

1. Reduce agitation. Agitation can be caused by stirring the metal in the crucible, by pouring from too high a level, or by stirring the melt with coolers. The use of plunging fluxes, the type that is submerged in the pot, may also be a cause of dross inclusions if time is not allowed for dross separation after treatment.

2. Overheated metal should be allowed to cool naturally to the correct pouring temperature. This is very likely to result in production delay but it is the best procedure in the long run, nonetheless. Time-saving substitute procedures, such as chilling with gates, are commonly followed with some success but they are not advisable.

Use many gates

3. Four gates. Maybe six gates or ten gates is a better answer. The point is that more rather than fewer gates are desirable so that heat is spread out in the mold; this means less local overheating of sand and less chance of shrinkage in any one area.

4. Bubbles located just under the casting skin are due to mechanically trapped air or steam. These bubbles are almost invariably located on the cope surface of the casting, indicating that they float to the top as foam, caused by splashing as the metal is poured down the sprue. This foam is carried into the casting where it floats to the top, since the gas is lighter than the metal; the tough oxide film at the surface prevents the gas from breaking through and disappearing.

The net result is that when the casting is sand-blasted or wire-brushed, or when a thin machine cut is made, the thin skin is taken off and holes which are likely to vary anywhere from 1/32 in. in diameter up to ¼ in. or larger are revealed. Such holes are not likely to be caused by dissolved gas in the metal because this type of gas is usually uniformly dispersed throughout the cross-section of the machined casting and not localized on the cope surface. As a matter of fact, dissolved gas porosity is more likely to be *less* concentrated at the skin than inside, because at the skin the chill is greatest.

The troublesome foam can be minimized or prevented by holding the lip of the crucible close to the sprue, by slanting the sprues, by using rectangular sprues and by choking the gates on each side at the bottom of the sprue so that it is easy to keep the sprue full.

5. The best holding furnaces for aluminum die casting machines are considered to be electric induction furnaces. Where ingot is being added directly to the furnace for die casting, this is the only furnace on which there is little possibility of sludge formation at the bottom. The reason for that is obvious. The heat is where it belongs, down at the bottom of the furnace *in the metal.* Also, the agitation due to the internal electrical stirring, which has no effect on dross inclusions, gives the best conditions for holding furnaces (for either die casting or permanent molding), especially if it is desired to add pig directly to the furnace.

Add titanium in foundry

6. No, additions in the foundry just prior to casting are the ideal. It should be added in the form of a 2½ or 5 per cent titanium hardener, enough to give from 0.05 to 0.1 per cent titanium.

7. The most effective degasser for aluminum is chlorine. Dry nitrogen will work but it is not quite so effective or so certain. Plunging fluxes are not as effective degassers because they are operative for such a short time; they may cause more difficulty than they eliminate.

8. No, iron melting pots do not generally last much longer than nonmetallic pots. With proper care nonmetallic pots will outlast iron, although there are foundrymen who will argue either way. The problem is one of proper care.

Watch pot coating

9. The answer is "No." There are many examples of pickup of 2 or 3 per cent and more from foundries which think they are properly coating the pot. They forget that they scrape off the coating by stirring and sliding ingots down the sides. Often they will coat the pot once a week or every ten days and think that is satisfactory. Actually it should be done every 8 hours to prevent all iron pickup.

10. The best pouring technique requires the lip of the pouring ladle to be close to the sprue. If the ladle has to be held high to get pressure, that means that there isn't sufficient venting in mold, that the back pressure is such that you can't get the aluminum in the mold, or that there are insufficient gates. It could mean, too, that the sand is not sufficiently open. The aluminum is so light that any back pressure due to steam is quite effective in requiring the so-called "pressure pouring" to which foundries resort. In aluminum it is generally not a good idea.

More than one remedy

11. If the casting shrinks at the gate, it is advisable to use one, or a combination of: more gates, pouring two up, venting the mold, risers on the gates. One remedy might work; two or three combined should produce the desired result.

12. A casting temperature is correct when it is as low as can be used and still get a good casting. The lowest pouring temperature doesn't always give the best appearance and the best casting. You can sometimes get shrinkage by pouring too low. Apparently the reason for this is that the alloy has so low a heat content at the low pouring temperature that it will no longer feed itself; hence you can actually get shrinkage where at higher pouring temperature there will be none.

13. The answer is "No." Porosity as such is not transferred. The porosity seen in an ingot (due to gas) is filled with molecular hydrogen; there is considerable proof that molecular hydrogen is not soluble in aluminum and atomic hydrogen cannot be obtained from the pores. Hence, no transfer of porosity.

Doesn't mean a thing

14. The answer is "No" because small variations in method of pouring ingots may make large changes in appearance, and once the metal is melted the shrinkage from the ingot has been eliminated—just as in remelting scrap castings or risers.

15. Of course, the answer is "No." The idea of "burning" aluminum doesn't have any metallurgical significance. It is a term that some people have decided means something and they use it. What a person means when he says you can "burn aluminum" is hard to define. What is probably meant is that some gas has been added to it, or the amount of oxide present on the melt has been increased and finds its way into the casting. It is possible to selectively oxidize small quantities of magnesium, but with this exception there isn't much else that can be lost.

Pin holes not connected

16. The answer is "No." High silicon alloys will, because of their casting characteristics and the nature of the metallurgical structure when the material is frozen, present a structure that is inherently pressure-tight even though it contains gas. That isn't true if the casting contains shrinkage. If it contains shrinkage, it will leak as much as any other alloy. However, assuming there is no shrinkage, there can be pin hole porosity and still no leakage even on machined surfaces simply because those pin holes are not connected. On low silicon alloys there is the problem of intercrystalline shrinkage which may not even be visible to the naked eye on a machined surface. Those very tiny cavities running along the grain boundries and dendrites will act as passages through which leakage can occur.

17. Copper, with nickel next.

18. Anodizing is a form of surface treatment.

A few of the VIP who were featured on the program when the Michiana Chapter celebrated National Officers Night early last month. They are (left to right) A. D. Matheson, National A.F.S. Director; George Anselman, Beloit Foundry Co., Beloit, Mich., one of the technical speakers of the evening; V. C. Bruce, Frederick B. Stevens, Inc., secretary of the Michiana Chapter, and National A.F.S. President I. R. Wagner.

chapternews

Goal in sight!

With their sights set on a membership target of 11,000 by June 30, the Society's Chapters forged ahead during February to another all-time high of 10,821 by the end of the month.

Thus, with four months of activity still ahead, including the stimulus of the first A.F.S. Convention in Chicago since 1940, the determined membership chairmen need only bring in 179 more new members to make the year's goal. (Ed.—We predict a "sell-out" long in advance of the Chapter Officers Conference in June, when membership award winners are announced.) One new Sustaining and six new Company members were added to the rolls during the past month, as follows:

SUSTAINING MEMBER

Sivyer Steel Casting Co., Milwaukee; M. A. Fladoes, Pres.—Wisconsin Chapter. (Converted from Company membership)

COMPANY MEMBERS

Anniston Foundry Co., Anniston, Ala.; H. Worth Little, Treas. (Birmingham District Chapter).

Link Belt Co., Indianapolis, Ind.; Carl O. Schopp, Asst. Gen. Supt. (Central Indiana Chapter). Converted from Personal

Jardine Bronze Foundry, Inc., Baldwinsville, N. Y.; Charles H. Meister, Asst. to Pres. (Central New York Chapter).

Standard Pattern Works, Regd., Montreal, Canada; O. Svendsen, Owner—Eastern Canada Chapter.

Specialty Products Co., Jersey City, N. J.; Samuel J. Singer, Jr., Sales Mgr. (Metropolitan Chapter).

Arrow Aluminum Castings Co., Cleveland; Peter J. Petto, Pres. (Northeastern Ohio Chapter).

Michiana

A. J. RUMELY, JR.
La Porte Foundry Co.

Some 138 members and guests gave National A.F.S. President I. R. Wagner and Director A. D. Matheson a rousing welcome early in February, when Michiana Chapter celebrated National Officers Night.

The two national officers met with chapter officers and directors in the afternoon and discussed chapter activities and national affairs. At the dinner session, Director Matheson gave a brief message of greeting and President Wagner then addressed the members at length concerning national activities. He complimented the chapter on its remarkable gain in membership. (Michiana was one of the first 10 chapters to meet '52-'53 membership quotas.)

After reassembling in ferrous and

Chow time at the February meeting of the Canton District Chapter found 120 members assembled for chicken dinner, a social hour, and a technical discussion on synthetic sands. (Photo was snapped by H. W. Wheeler, Superior Foundry, Inc., Cleveland.

Record enrollment in Birmingham District Chapter's Apprentice Contest is reviewed by Contest Chairman T. H. Benners Jr., T. H. Benners Co., and Albert H. Fruchtl, U. S. Pipe and Foundry Co., both of Birmingham.

Huddle at recent meeting of Twin City Chapter includes (l. to r.) D. R. Forrest, Cleveland-Cliffs Iron Co., O. J. Myers, Archer-Daniels-Midland Co., and R. C. Wood, Minneapolis Electric Steel Castings Co., Minneapolis.

Three-time winner in Oregon Chapter's A.F.S. Building Fund Raffle, Clarence Johnson, Electric Steel Foundry Co., Portland, displays his latest prize—a Pendleton wool shirt. Norman Hall (same company) took the picture.

non-ferrous groups, George Anselman, Beloit Foundry Co., Beloit, Mich., addressed the ferrous group on the subject of "Sand Control", illustrating his lecture with slides.

Walter E. Sicha, Aluminum Co. of America, talked to the non-ferrous group on "Aluminum Alloys-Fabrication and Applications." A social hour preceded and followed the serving of an excellent roast beef dinner.

Canton District

H. W. WHEELER

Superior Foundry, Inc.

Alexander D. Barczak, Superior Foundry, Inc., Cleveland spoke on "Synthetic Sand in a Production Foundry" at the February meeting of the Canton District Chapter. His talk was illustrated by slides of equipment and operations in the speaker's own plant.

Ticket stubs were used for the drawing for two free dinners which were won by J. E. Fawcett, Orrville Bronze & Aluminum Foundry and H. A. Biddinger, F. E. Myers & Bro. Company.

Eastern New York

D. M. BROWN, JR.

General Electric Co.

At the January dinner meeting, members heard W. T. Bean, Detroit, tell about "Good Design on Purpose." He began his speech cleverly by first asking who was present, i.e. (metallurgists, engineers, overhead, etc.) He spoke to each group indicating how each could better manage its work.

Mr. Bean illustrated his talk with slides, showing failures resulting directly from poor design and discovered by use of strain gauges. He stated that the claim that the piece which broke was overstressed, is often wrong.

A design engineer, Mr. Bean claims there is no better way to get good designs than to gather the group concerned, pattern makers, foundryman and engineer and each face the proposed model with a ball of modeling clay and enough "give and take" to come up with a casting.

Twin-City Chapter

R. J. MULLIGAN

Archer-Daniel-Midland Co.

An optimistic note was sounded regarding the iron ore future of the Minnesota-Wisconsin iron ranges by D. R. Forrest, Cleveland-Cliffs Iron Co., at the January meeting of the Twin-City Chapter. Following recent discouraging announcements that these important iron ranges were about depleted of high grade ore, Mr. Forrest's subject was

Friendly get-together at February meeting of Chicago Chapter united trio of long-time friends (l. to r.) T. J. Magnusen, Champion Foundry & Machinery Co., J. C. Gore, Archer-Daniels-Midland, and H. G. Schlichter, Beardsley & Piper, all of Chicago.

Entertained by Chicago Chapter's charming accordionist, group from Howard Foundry, Chicago, includes Theodore Haines, Fred Kasch, Adam Plunge, George Schoeneck, and a father-and-son team Roy Frazer and his son Richard, a Korean veteran.

particularly timely in its optimistic note.

The optimistic outlook of The Cleveland-Cliffs Iron Co., is based largely on technological advances in ore beneficiation techniques which have made it more profitable to mine the lower grade ores which lie closer to the surface than the present deep-lying veins of high grade ore.

Tangible evidence that The Cleveland-Cliffs Iron Co. is not alone in expressing optimism is offered by Erie, Oliver and Reserve Mining Companies, who will employ 11,000 persons in their program for utilization of lower grade ores. Cleveland-Cliffs' Taconite program alone will employ 7,500.

Where does the foundryman benefit from these programs? Mr. Forrest pointed out that this type of ore beneficiation requires massive equipment. 625 ton crushers with 3,500 to 4,000-ton capacity. Many pieces of such equipment will be needed, providing new foundry markets.

Oregon

NORMAN E. HALL

Electric Steel Foundry Co.

Featured speaker at the January meeting of the Oregon Chapter, was C. V. Nass, Beardsley & Piper, Chicago. Mr. Nass spoke of the subject of "Mechanization in Molding" and described the various phases of foundry mechanization for production-line work.

The film, "Mechanization in the Foundry", shown following the speaker's talk, illustrated the high degree of mechanization to which some foundries have gone in their sand conditioning, molding, pouring and other related foundry practices.

St. Louis District

FRED J. BOENEKER

Bronze Alloys Co.

"How About Becoming Sand Conscious?" was the question put to St. Louis District foundrymen by Charles B. Schureman, Baroid Sales Division, National Lead Co., Chicago, at the February meeting. The district's "own sand expert," Henry W. Meyer, General Steel Castings Corp., Granite City, Ill., served as technical chairman of the session.

In a straight-off-the-shoulder talk, Mr. Schureman described the many sins committed in sand handling operations. He pointed out the importance of instituting a more scientific approach to the sand problem and gave concrete examples of good and bad sand practice observed in both large and small foundries. Choice of correct base sand and care in measuring and weighing ingredients were cited as being of paramount importance.

Mr. Schureman also pointed out that uniform baking temperatures within core ovens are essential, and recommended period checking of control in-

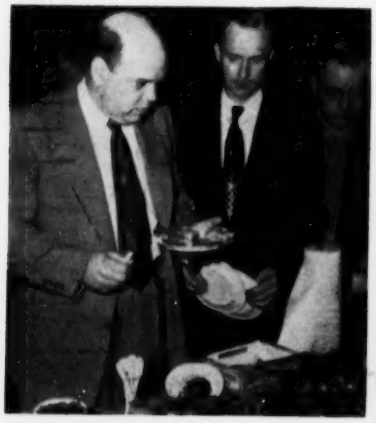
Easy to identify this picture—smiles mean it's dinner time, size of smiles mean it's Texas. Photo was snapped just as members of the Texas chapter filed in for food at recent meeting.

Panel which discussed non-ferrous castings at recent Philadelphia Chapter meeting included (l. to r.) Robert Hunter, Archer-Daniels-Midland Co., Cleveland, J. S. Roberts, American Manganese Bronze Co., James Vanick, International Nickel Co., New York, Arnold Kraft, Wilkening, Mfg. Co., Philadelphia, Donald Bryden, Philadelphia Bronze and Brass Co., and B. A. Miller, Baldwin-Lima-Hamilton Corp., Lansdowne, Pa.

In serious mood during February meeting of St. Louis District Chapter are (l. to r.) E. R. Belton, Progressive Pattern Co., St. Louis, Walter A. Zeis, Walter A. Zeis Foundry Supplies & Equipment Co., Webster Groves, Mo., Charles B. Schureman, National Lead Co., Green Valley, Ill., H. W. Meyer, General Steel Castings Co., St. Louis, W. L. Kammerer, Midvale Mining & Mfg. Co., St. Louis, A. A. Hilbron, A.F.S. Convention Manager, and Paul E. Retzlaff, Nordberg Mfg. Co., St. Louis. Mr. Schureman spoke to the group about sand handling.

Guest Speaker Chester V. Nass, Beardsley & Piper Co., Chicago, poses with Harold G. Pagenkopp, Angelus Pattern Works, Huntington Park, Calif., at a recent dinner meeting of the Southern California Chapter.

Entertainment, good fellowship, and plenty of fun were the order of thing at the Chesapeake Chapters annual Oyster Roast (see photos below and item on page 102).



Raw oyster bar was the center of interest at the Chesapeake feast, but there were also oyster fritters, oyster stew, fried oysters—all this and pigtails, pig knuckles with sauerkraut, roast beef, hot dogs and (as you can see at right) plenty of "suds" to wash away every care. Gala event was attended by 350 members and guests despite raging three-day storm. Report of all who were there: "Best Chesapeake party we've ever had!"

struments and the installation of additional thermocouples, if needed to achieve more uniform temperature control.

All sand preparation and handling operations should be entrusted only to trained and experienced operators. Good sand practice, the speaker pointed out, will pay dividends in the form of improved casting quality, fewer casting rejects and greater customer satisfaction.

Texas

FRANK ROEWER
Texaloy Foundry Co.

San Antonio played host to the January meeting of the Texas Chapter, held on Friday, January 16, in the Menger Hotel.

The meeting featured Mr. W. R. Jaeschke, Whiting Corporation, Harvey, Ill., as principal speaker. His subject was "Source of Trouble in Cupola Operations". Some interesting slides on the various phases of cupola operation were presented as well as a film entitled "A Report Summarizing the First Five Years of Foundry Educational Foundation Activities."

The meeting, attended by members representing all the leading foundries and suppliers in the Texas Chapter, was one of an impressive series scheduled for the year.

Southern California

K. F. SHECKLER
Calmo Engineering Co.

January meeting of the Southern California Chapter was held at the Roger Young Auditorium. Speaker of the evening was Chester V. Nass, Beardsley and Piper, Chicago, who spoke on "Mechanization in Molding."

Mr. Nass suggested that a very careful survey should be made of any plant layout, as well as the type of castings produced, before consideration be given to the mechanization of all molding operations. It was pointed out that production foundries generally lend themselves more readily to mechanization than a jobbing foundry which produces relatively small quantities of a wide variety of castings.

It was pointed out that most foundries proceed with sand conditioning and handling equipment prior to the installation of mechanized molding and shake-out equipment because through the use of properly conducted molding sand, the foundry is generally able to reduce the percentage of faulty castings as well as effect a saving in raw material replacements.

Mr. Nass stressed the importance of preparing a master plan for the molding mechanization program and then installing the component phases as the need for additional production and lower unit costs become apparent.

Cincinnati

DAVID J. PUSACK
The Cincinnati Milling Machine Co.

Still talking about the biggest Christmas party in the Cincinnati Chapter's history, members returned to the more professional level with their January meeting. J. G. Winget, Reda Pump Co., Bartlesville, Okla., spoke to the group about a direct-fired, reverberatory-type melting furnace for gray iron, ductile iron and brasses which he built in 1950.

This small capacity furnace proved so successful that today there are hundreds in use around the country. In his talk, Mr. Winget indicated the melting economies effected by use of gas or oil over electricity for heats of a few thousand pounds, the time savings effected and the advantages available to both large

Surveying festivities at Metropolitan Chapter's gala Christmas party are Bernard N. Ames, U. S. Naval Shipyard, and James S. Vanick, International Nickel Co., New York, Chapter Chairman.

Members gathered at tables in individual foundry groups, then mixed it up later during elaborate program of entertainment. For other pictures of other Metropolitan groups see bottom of page.

and small shops by having such units installed.

The technical program for the January meeting was preceded by dinner and followed by a period of refreshments and sociability.

Central Michigan

DON I. HUIZENGA

Albion Malleable Iron Co.

Approximately 125 members and guests attended the January meeting of the Central Michigan Chapter where final plans for the metallurgical course held February 3 through March 12, were discussed.

Collins Carter, National Vice President of A.F.S., reviewed the accomplishments of the Society and expressed pride in being a member of the Central Michigan Chapter because of its leadership in sponsoring activities such as the Metallurgical School.

Guest speaker for the evening was Wm. G. Ferrell, Auto Specialties, Benton Harbor, Mich., who spoke on the advantages of control in cupola operations. Close control of melting practice, Mr. Ferrell said is not only possible but absolutely essential to good operations in all foundries regardless of size.

To emphasize this point the speaker related how sulphur content of metal at his plant had been held to .002. He stressed that close control must be maintained over all foundry operations in order to produce uniform castings.

Reviewing briefly the technical progress in cupola control to date, Mr. Ferrell indicated that he believes continued industry-wide research and development of both processes and product are necessary to maintain competitive advantages.

Central Illinois

L. E. KINSINGER

Caterpillar Tractor Co.

Effective essentials required to make good castings was the topic discussed by Wm. Ball, Jr., R. Lavin & Sons, Chicago, Ill., at the February meeting of the Central Illinois Chapter.

Mr. Ball said, that regardless of the type of metal being cast, 80 per cent of the problems are common to all casting processes. However, each base should be considered individually as they all act differently. More use should be made of fracture test specimens.

Tests should be made for each base, Mr. Ball believes, to establish the high and low limits of each heat so that the desired chemical and physical analysis can be maintained. Foundry practice should be an exact science, he asserted.

Approximately 120 attended the meeting representing, besides the Peoria area, Decatur, Champaign, Bloomington, and Vermont, Illinois.

Chesapeake

Early in January, 350 strong, members of the Chesapeake Chapter, their guests and friends enjoyed their annual oyster roast—in spite of the ice and hail that had swept the Middle East for three days. There were guests from the Philadelphia Chapter, from Conestoga Foundrymen's Association, and from the Reading Foundrymen's Association.

The Oyster Raw Bar was the center of interest—clams also were shucked. And there were oyster fritters, oyster stew and fried oysters for those who like them served hot. All this and pigtails, pig knuckles with sauer kraut, roast beef, and even hot dogs—for those whose taste did not run to seafood. Flagons of beer and urns of coffee topped the menu. For good or ill, there was no limit to the quality or the selection of food consumed by the guests.

Northeastern Ohio

ROBERT H. HERRMANN

The Dietert Sand School was conducted Jan. 29-31 by Frank S. Brewster,

Happy quartet at recent meeting of Central Michigan Chapter included (l. to r.) Robert Mason, Engineering Castings, Marshall, Mich., William Ferrell, Auto Specialties, Benton Harbor, Mich., David Boyd, Engineering Castings, and Jack Secor, Hill & Griffith, Niles, Mich. Mr. Ferrell was guest speaker of the evening.

Voice of experience is heard by Student members of the Twin-City Chapter as they chat with Foundry Superintendent L. W. Williamson, Minneapolis Moline, Hopkins, Minn., at a recent combined meeting attended by 125 members and guests. Photo was snapped by R. J. Mulligan, Archer-Daniels-Midland Co., Minneapolis.

Harry W. Dietert Co., Detroit, for the Northeastern Ohio Chapter. Mr. Brewster discussed reasons for sand control, how it is applied, basic principles and how to organize a control program. He advised that foundrymen, in testing sand, should test the mix they intend to use and not the oil, sand and binders alone. In that way a true picture of the properties will be obtained. He described sand as a bundle of properties all of which have a "best range" except expansion. That should be kept as low as possible—but he admitted that it is extremely difficult to control.

Various control tests for determining characteristics and properties of sand were explained with emphasis on their practical application as an aid in obtaining better castings. Casting defects also were described with explanations of their causes and suggestions for their elimination. The school was concluded with discussion of individual sand problems experienced by those attending.

Birmingham

J. P. MCCLENDON

Stockham Valves and Fittings

Dielectric Core Baking was the subject that attracted approximately 100 foundrymen and friends to the January meeting in Birmingham. Guest speaker J. Wesley Cable, Girdler Corp., Louisville, Ky., described the rapid development of the process since its beginning only eight years ago.

Much research and experimentation in sand binders and core drying equipment was necessary to give foundrymen the results required. For example, cores in iron driers would not bake on the bottom half. A new material was developed and fabrication and use of plastic shell-type driers now causes the cores to bake out uniformly. Driers are constructed so that the sand can be blown right into the drier to form the core. In dielectric baking, the thin sections of the cores bake out and then without feeling further effect from the baking process just wait on the heavier sections to finish baking out.

Two features that make this system more desirable than the conventional type baking ovens are (1) the short time required for baking out, (2) the small number of driers required in the process. In addition driers can be used again almost immediately when they come out of the heating unit because they do not heat up like the old conventional type drier.

Guest Speaker B. A. Lawson (left), Harrison Steel Castings Co., Attica, Ind., discusses program for Central Indiana Chapter's February meeting with Technical Chairman R. H. Bancroft, Perfect Circle Corp., New Castle, Ind.

Central New York

DONALD CARTER

Crouse-Hinds Co.

The February meeting of the Central New York Chapter attracted 105 members and guests. Several new members were introduced.

Featured on the program were two films, one a progress report on the Foundry Educational Foundation and the other, "The Effect of Gating Design on Casting Quality" produced by the Research Committee, Light Metals Division, A.F.S., which was presented by S. C. Massari, Technical Director of A. F. S. The film covered research on the action of metal as it enters the mold cavity.

In the experiments shown, lucite molds were used with small holes drilled at certain points to simulate the permeability of a sand mold. Water was used to simulate liquid metal. It was found that a straight sprue and right angled, rather than rounded corners tend to aspirate air into the metal and thus increase the danger of a defective casting.

Corn Belt

VERN HOLMES

Paxton Mitchell Co.

Corn Belt Chapter members met in February with Ralph Clark, Electro-Metallurgical Company, Detroit, who presented a slide-illustrated lecture on "Metal Structures".

Mr. Clark reviewed many differences in Steel and cast iron structures, different types of carbon distribution, and spent quite a little time in answering questions on effects of alloys on metal structures.

Joe Elliott from Western Land Roller Company, Hastings, Nebr., regaled the group with his ad-lib comments on the gray iron foundry trade.

Eastern Canada

C. B. SEBISTIANOWICH

Dominion Engineering Works, Ltd.

The Eastern Canada Chapter heard an informative talk by L. A. Kleber, General Steel Casting Corp., Granite City, Ill. The subject discussed was "Trend and Development of Cast Products".

Mr. Kleber pointed out that the Foundry industry is one of the most basic to the future development of Can-

ada. A necessary requisite in measuring up to that role is for the foundry to employ personnel with both technical and practical knowledge from the Executive level down to the worker.

Mr. Kleber mentioned that stress-strain analysis generally results in an overall reduction in costs due to increased simplicity of design etc., and thus benefits both the producer and the customer. "Product development," the procedure of which has changed with the passing years, has resulted in financial benefit to all concerned. P. Von Colditz, Canadian Car and Foundry Co. Ltd., Montreal, Que., acted as technical chairman for the meeting.

Mo-Kan Chapter

T. F. SHADWICK
Witte Engine Works

Guest of the evening at the Mo-Kan Chapter February meeting was Albert Hunt, American Brake Shoe Co., St. Louis, who is a national Director of A.F.S.

Mr. Hunt outlined to Mo-Kan Chapter members the new plan of A.F.S. to provide more adequate representation of all chapters through a Directorate. He said there would be men to help in the problems of the foundry industry such as safety, health, air pollution, and in the supplying of foundry engineers through the various engineering colleges in each district.

In the technical session, Ralph Clark explained the characteristics of the different types of cast iron.

At nine o'clock the meeting adjourned. A large size television set at each end of the meeting room was turned on and nearly everyone stayed to watch the world welterweight championship prize fight between Kid Gavilan and Chuck Davey.

Central Ohio

WILFRED H. WHITE
The Jackson Iron & Steel Co.

"Aspects of Nodular Iron" was the topic of a paper presented at the February meeting of the Central Ohio Chapter. Tom Eagan, Cooper-Bessemer Corp., Grave City, Pa., presented the paper on this subject which continues to attract great interest among foundrymen.

Cooper-Bessemer has been one of the major producers of Nodular as well as a user. Mr. Eagan, therefore, has been able to evaluate nodular iron from an engineering standpoint. He has seen thousands of tons produced and has evaluated nodular performance in service. Mr. Eagan points out that Nodular Iron has physical properties of its own. In general it is superior to malleable iron and gray iron but below steel so far as tensile properties are concerned. As such, it takes a place somewhere between these well-known ferrous materials. He believes that its competition with steel castings will be greater than with either malleable or gray cast iron.

The Central Ohio Chapter has tentatively set Saturday, June 20, as the date for its annual picnic. Location is Columbus Riding Club, Columbus, Ohio. Picnic chairman is Cyril Braun, Laclede Christy Clay Products, Columbus.

The Big Story

You've heard the radio program describing "The Big Story" of some newspaper reporter. AMERICAN FOUNDRYMAN believes every Chapter has its own "big story" each year. It may concern a special program, an educational job, a successful meeting, a membership drive, a Chapter publication, some form of contest, a public relations effort, or some other such event.

If 10 or more Chapters send in their "Big Story of 1952-53," the best three will be printed in the June AMERICAN FOUNDRYMAN. In addition, all entries will be reproduced for the 1953 Chapter Officers Conference.

Here are the only conditions: (1) To make it a contest, at least 10 entries must be received not later than May 1. (2) A Judging Committee comprised of A.F.S. Board members will pick the best three. (3) Decision will be made on the basis of evident initiative, originality of effort, intelligent planning, results. (Neatness, spelling and literary style will *not* be deciding factors). (4) All entries must be of 500 words or less.

If response warrants it, it is possible that this will be an annual contest. At any rate, it's on for this year. First, write that you will have an entry. Then send, prior to May 1, your entry for "The Big Chapter Story of 1952-53." Photographs are important.

Central Indiana

WILLIAM H. FAUST
Electric Steel Castings Co.

"Sand Reclamation" was the topic of discussion at the Central Indiana Chapter's February dinner meeting. Guest Speaker for the evening was B. A. Lawson, Harrison Steel Castings Co., Attica, Ind., who explained the system used in his plant.

Properties of the sand obtained from the system are very important, Mr. Lawson pointed out. Installing the sand reclamation unit meant the entire sand system had to be revamped. With this completely mechanized system daily tests are a "must", and the addition of new sand to the system is dependent upon those tests. The per cent consumption of new sand is 500 pounds per ton of castings produced.

In addition to saving in the cost of sand used in producing castings many other savings are being realized. Improved surface finish, for example, and the resulting decrease in cleaning costs.

Detroit Chapter

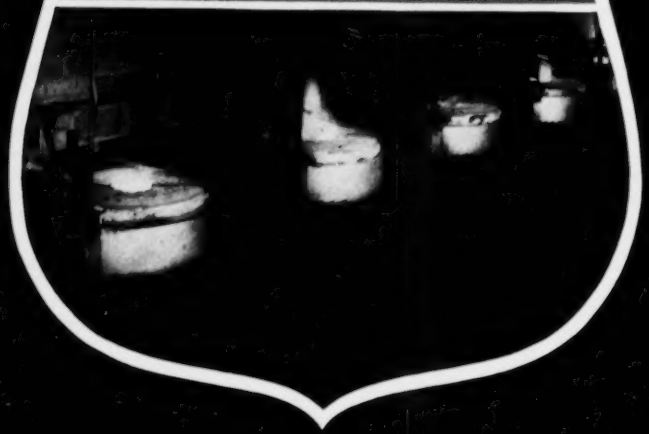
WALTER KANTZLER
Kelsey-Hayes Wheel Co.

Approximately 95 members and guests attended the January 15 meeting to hear Burr Allen, Tank Automotive Center, National Production Control Division,

Only a small part of the happy crowd (more than 1,000) who participated in Northeastern Ohio Chapter's Christmas party. For more recent NEO Chapter activities see news item.

HAUSFELD
FURNACES

FOR GAS
OR FUEL OIL



ARE MEETING EVERY EXACTING
REQUIREMENT

FURNACES FOR
BRASS • ALUMINUM • MAGNESIUM
AND ALL OTHER
NON-FERROUS ALLOYS

HAVE YOU INVESTIGATED THEM
FOR YOUR MELTING PROBLEMS?

The Campbell-Hausfeld Co.
900-920 MOORE ST. HARRISON, OHIO

discuss "Foundry and American Ordnance".

The talk was designed to present the Broad Aspects of the relation between the foundry industry and tank ordnance. Mr. Allen said that tank ordnance has two (2) main functions (1) Provide capacity for odd castings I.E. armor (2) purchase of parts items, one-half of which are castings. He added that these functions are based on peace, all-out war, or a period of limited action. A lively question and answer period followed Mr. Allen's talk.

Rochester

H. G. STILLWAGEN

Hetzler Foundries, Inc.

Rochester pattern makers registered a record attendance at the Chapter's February 3 meeting to hear Walter Siebert, Cleveland Standard Pattern Works, Cleveland, explain how to make a good pattern.

Mr. Siebert stated that the foundry industry is fast approaching "push button" operation and that pattern making requires new skills. The industry must educate new men in the science.

With the aid of charts illustrating the construction of pattern equipment, Mr. Siebert showed step-by-step construction of a pattern.

Tennessee

PORTER WARNER, JR.

Porter Warner Industries

The Speaker at the January meeting of the Tennessee Chapter was A.F.S. National Director James T. MacKenzie, American Cast Iron Pipe Co., Birmingham. Before the technical session, Mr. MacKenzie met with the directors in a regular board meeting and spoke of the progress the Society had made during the present year.

Subject of the technical session was "Chemical Changes in the Cupola". Mr. MacKenzie used slides and charts to illustrate his speech.

Chapter members heard with pride that the Board of Directors had set aside a fund of $2,000 to purchase additional equipment for the Foundry School being established at Kirkman Vocational School. Much of the equipment necessary for the school has already been secured. John Lasater, Combustion Engineering Co., Chattanooga was made chairman of a committee to secure the additional funds required.

Missouri School of Mines

SID COLE

The student chapter at the Missouri School of Mines held their February meeting in conjunction with a meeting of the American Society of Metals.

Speaker for the evening was Dick Whanger, Hughes Tool Co., Houston, Tex., who spoke on the "Metallurgical Aspects of Oil Well Drilling Tools."

Chapter meetings

March

17. . Eastern New York
Circle Inn, Latham, N. Y. Richard Herold, Foundry Products Dept., Borden Co., New York. *"Shell Molding."*

18. . Central Michigan
Hart Hotel, Battle Creek, Mich. A. J. Grindle, Grindle Corp., Markham, Ill. *"Dust, Smoke and Fume Control."*

18. . Oregon
Portland, Ore. William S. Pellini, Metal Processing Branch, Metallurgy Div., Naval Research Laboratory, Anacostia, Va. *"Feeding Range of Risers."*

19. . Washington
Everett, Wash. William S. Pellini, Metal Processing Branch, Metallurgy Div., Naval Research Laboratory, Anacostia, Va. *"Feeding Range of Risers."*

19. . Detroit
Detroit-Leland Hotel, Detroit. Sustaining members night. Gosta Vennerholm, Ford Motor Co., Dearborn, Mich. *"Developments in Shell Molding."*

19. . Penn State
Foundry Classroom. Penn State College, Pa. J. D. Caster, Harbison-Walker Refractories. *"Foundry Refractories."*

20. . Texas
Fort Worth. Thomas E. Barlow, Eastern Clay Products Dept., International Minerals & Chemical Co., Chicago. *"Casting Defects as Related to Sand Practice."*

20. . Birmingham District
Anniston, Ala.

20. . British Columbia
Vancouver Vocational Institute. William S. Pellini, Metal Processing Branch, Metallurgy Div., Naval Research Laboratory, Anacostia, Va. *"Metallurgical & Mechanical Aspects of Hot Tearing."*

23. . Northwestern Pennsylvania
Moose Club, Erie, Pa. Father and Son Night. R. Agresti, attorney.

27. . Chesapeake
Engineering Club, Baltimore, Md. Richard P. Dunphy, Naval Research Laboratories, Anacostia, D. C. *"Nodular Cast Iron."*

27. . Ontario
Leonard Hotel, St. Catherines, Ont. Staff members, Massey-Harris "M" Foundry, Brantford, Ont. *"Shell Molding."*

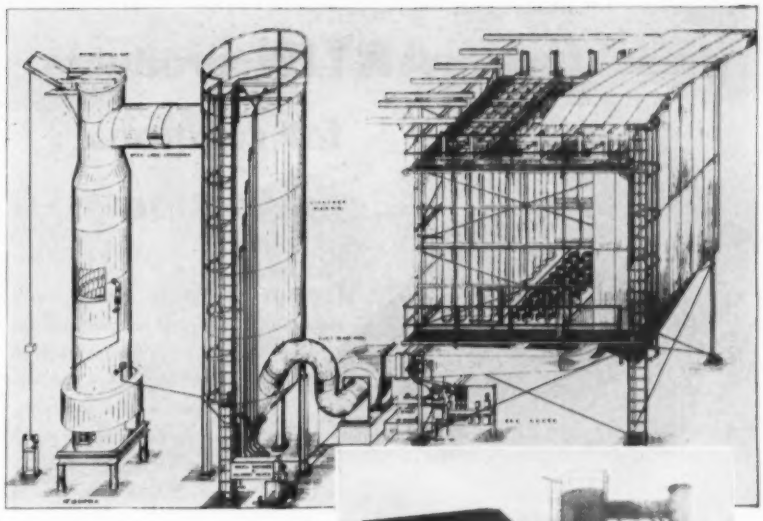
27. . Tennessee
Patten Hotel, Chattanooga, Tenn. *"Safety-Hygiene-Air Pollution."*

27. . Chesapeake
Engineers Club, Baltimore, Md. Richard P. Dumphy, Naval Research Laboratories, Anacostia, D. C. *"Nodular Cast Iron."*

April

1. . Toledo
Toledo Yacht Club

2. . Canton District
Mergus Restaurant, Canton, Ohio. J. A.



FOUNDRYMEN

SMELTERMEN

Carbon Black and Other Non-Metallic Industries

Investigate Now!

Simple structural steel construction is an important feature of the Harsell dust and fume control system shown as installed at Quality Foundry, Los Angeles. The unit may be purchased complete, or detailed drawings can be furnished for your own fabrication.

HARSELL

DUST & FUME CONTROL SYSTEMS

* **With bag houses containing silicone treated, glass fabric bags.**
* **For handling high temperature gases.**

OFFER THESE TEN IMPORTANT ADVANTAGES

1. LOW INITIAL COST.
2. LOW MAINTENANCE — low operating costs.
3. SIMPLE FABRICATION, erection and operation.
4. STANDARD STRUCTURAL STEEL CONSTRUCTION — bag house framing built entirely of standard structural steel.
5. HIGH TEMPERATURE OPERATION — Systems are capable of handling gases up to 2500° F with bag house operating temperatures up to 510° F.
6. MINIMIZE CORROSION — Water evaporation eliminates sludge and corrosion problems.
7. ATMOSPHERIC COOLERS — May be substituted for quencher. Neither is required where gas temperatures are around 500° F.
8. AUTOMATIC TEMPERATURE CONTROL — Temperature controls are fully automatic, with a semi or fully automatic bag shaking mechanism.
9. CUSTOM BUILT — Designed to meet your individual requirements.
10. A PACKAGED UNIT — May be purchased as a packaged unit, or detailed drawings can be furnished for competitive bidding, or your own fabrication.

Now installed in seven Los Angeles Area foundries. Approved by Los Angeles County Air Pollution Control District. GET FULL DETAILS.

HARSELL ENGINEERING CO.
Dust, Fume & Odor Control Systems Pioneers in High Temperature Filtration
THOMAS L. HARSELL, JR.
President
(B.S. in Chem. Eng.)
1628 Hermosa Avenue
Hermosa Beach, Calif.
Phone FRontier 4-0543

HARSELL ENGINEERING CO.
1628 Hermosa Ave., Hermosa Beach, Calif.

Please send me descriptive literature on Harsell Dust & Fume Control Systems.

Name.....
Firm.....
Address.....
City.....

these MARTIN products for core box protection

PETERSON VIBROLATOR quietly moves materials from bins and hoppers. Always instant starting. No maintenance, no lubrication. "Vibra-Tak" pocket-size vibration meter available. Check dead spots on vibrated match plates, bins, hoppers.

"SAND ARRESTER TUBE"

Save cores and step up production. Guaranteed for 100,000 blows.

"HOLINER" BUSHINGS

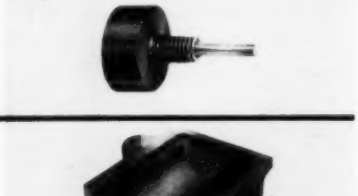
Stop abrasion between blow plate and core box. Protect blow holes.

"PROTEXABOX" PINS

Cannot mar the box face because of protective rubber tip. Guaranteed to stay on.

"PULLINSERT" BLOW BUTTONS

Positively stop sand blasting under blow holes. Available in nine popular sizes.



"STRIPINSERT"

Protects parting line — easily installed in old or new boxes. Cutters for groove available at moderate cost.

NON-BINDING FLASK PINS

No production stoppages due to bending or binding of flask pins. Flexes and absorbs abuse, assures easy, perfect match.

See your distributor or write for literature to—

MARTIN ENGINEERING COMPANY

KEWANEE 3, ILLINOIS

Gitzen, Delta Oil Products Co., Milwaukee. *"Sand Additives."*

2. . Saginaw Valley
Fischer's Hotel, Frankenmuth, Mich. J. S. Vanick, International Nickel Co., New York. *"Heat Treatment of Cast Iron."*

3. . Western New York
Sheraton Hotel, Buffalo, N. Y. J. S. Vanick, International Nickel Co., New York. *"Progress in Foundry Products by Alloying."*

3. . Mid-South
Hotel Chisca, Memphis, Tenn. *"Basic Cupola Practice."*

6. . Western Michigan
Bill Stern's Steak House, Muskegon, Mich. Movie, *"Steel with a Thousand Qualities."*

6. . Metropolitan
Essex House, Newark, N. J. Clyde B. Jenni, General Steel Castings Co., Eddystone, Pa., *"Non-Destructive Testing."*

6. . Central Indiana
Athenaeum, Indianapolis. R. A. Witschey, A. P. Green Firebrick Co., Chicago. *"Foundry Refractories."*

6. . Chicago
Chicago Bar Association, Chicago. Round Table Meetings.

6. . Central Illinois
American Legion Hall. D. A. Farrell, United States Steel Co., Pittsburgh. *"Single Objective Approach to Safety."*

7. . Rochester
Seneca Hotel, Rochester, N. Y. Donald J. Reese, International Nickel Co., New York. *"Gray Iron Foundry Practice."*

9. . St. Louis
York Hotel, St. Louis, Mo. John A. Mescher, Unitcast Corp., Toledo, Ohio. *"Core Blowing."*

9. . Northeastern Ohio
Tudor Arms Hotel, Cleveland. Chas. E. Nelson, Dow Chemical Co., Midland, Mich. *"Magnesium and Aluminum Foundries."* Metallurgical pictures of production problems in grey iron, steel, and malleable iron.

16. . Eastern Canada
Mount Royal Hotel, Montreal. C. E. Westover, Westover Engineers, Milwaukee. *"Mechanization for Small Foundries."*

10. . Philadelphia
Engineer's Club, Philadelphia. W. G. Parker, General Electric Co., Elmira, N.Y. *"Green Deformation in Molding Sands As an Aid in Sand Control."*

10. . Central New York
Statler Inn, Cornell University, Ithaca, N. Y. Clyde A. Sanders, American Colloid Co., Chicago. *"How Can Molding Sand Contribute Toward Apparent Metal Shrinkage?"*

10. . Corn Belt
Rome Hotel, Omaha. W. A. Hambley, Chas. Krause Milling Co., Birmingham, Mich. *"Aluminum Casting Defects and Their Correction."*

10. . Southern California
Rodger Young Auditorium, Los Angeles.

R. A. Quadt, Hunter Douglas Corp., Riverside, Calif. *"Some Effects of Alloying Elements on Properties of Aluminum Castings Alloys."*

13. . Central Ohio
Seneca Hotel, Columbus, Ohio. J. A. Jackson, Battelle Memorial Institute, Columbus. A.F.S. movie, *"Effect on Gating Design on Casting Quality."*

13. . Cincinnati
Zigmond Madacey, Caterpillar Tractor Co., Peoria, Ill. *"Core Making and Core Blowing."*

13. . Michiana
Hotel Elkhart, Elkhart, Ind. Entertainment.

13. . Timberline
Oxford Hotel, Denver. D. L. La Velle, American Smelting & Refining Co., Barber, N. J. *"Aluminum Casting Defects and Their Correction."*

13. . Twin City
Covered Wagon, Minneapolis, Minn. Jack Caine, Consultant, Cincinnati, Ohio. *"Sandsandsandsandsands."*

14. . Eastern New York
Circle Inn, Latham, N. Y. Joint meeting ASM.

14. . N. Illinois—S. Wisconsin
Faust Hotel, Rockford, Ill. Clyde A. Sanders, American Colloid Co., Chicago. *"How to Obtain Best Molding Results and Castings with What You Have."*

15. . Central Michigan
Hart Hotel, Battle Creek, Mich. Richard Herold, Chemical Div., Borden Co., New York. *"Shell Molding, Castings and Cores."*

16. . Detroit
Plant visitation.

16. . Penn State
Foundry Classroom, Penn State College, State College, Pa. J. C. Kremer, Central Foundry Div., General Motors Corp., *"Shell Molding Production."*

17. . Texas
Lufkin, Texas. Afternoon meeting, Texas Foundries, Inc. Jolt-squeeze molding machine demonstration. Fred G. Sefing, International Nickel Co., New York. *"Management's Responsibility for Education in the Foundry."*

17. . Birmingham District
University of Alabama, Tuscaloosa, Ala.

17. . Tri-State
Bartlesville, Okla.

20. . Quad City
Fort Armstrong Hotel, Rock Island, Ill. Boss' Night. Charles Arp, Allis-Chalmers Manufacturing Co., Milwaukee. *"Our Most Valuable Asset."*

▶ *Chapter Officers Conference*

Dates for the Chapter Officers' Conference this year are June 18-19. Place is the Sherman Hotel, Chicago. As in the past two years, invitations have been extended to 1953-54 Chairmen (in most cases, *present* Vice-Chairmen), and to 1953-54 Program Chairmen (in most cases, *incoming* Vice-Chairmen).

You can blame us for
OBSOLESCENCE

OBSOLESCENCE IS MORE than a matter of age—it's often Man-made. The fork trucks you bought from us 10 years ago were the best money could buy—THEN. But today they're obsolete.

And frankly, *we're* responsible for it. Obsolescence is the result of what we've been doing the past 10 years: constantly working on ways to improve those trucks. Our older models never saw the day when they could come close to what we're building now. These new CLARK trucks are designed to do more work—and do it faster, better and at lower cost. They're built to last longer. And with the multi-job attachments we've developed for them, they not only do more work, they do more *kinds* of work. Today's truck is amazingly adaptable and extra-useful.

Here's a complete line of modern trucks—gas, electric and diesel powered—that will outproduce your old equipment. You bought your original truck because you wanted to cut costs and increase efficiency. Now, competitive cost is more important than ever. And now is the time to replace the old equipment.

Your local CLARK dealer can give you the prescription for curing obsolescence—the specific reasons why *new* CLARK trucks are an investment in money-saving. Yes, you can blame us for obsolescence. But when you see what our new equipment will do for you, we're pretty sure you'll thank us for it.

CLARK ELECTRIC AND GAS POWERED FORK TRUCKS
AND POWERED HAND TRUCKS · INDUSTRIAL TOWING TRACTORS

1903 1953
CLARK EQUIPMENT

INDUSTRIAL TRUCK DIVISION • CLARK EQUIPMENT COMPANY • BATTLE CREEK 155, MICHIGAN
Please send: ☐ Material Handling News ☐ Movie Digest ☐ Have Representative Call.
Name _____
Firm Name _____
Street _____
City _____ Zone _____ State _____
AUTHORIZED CLARK INDUSTRIAL TRUCK PARTS AND SERVICE STATIONS IN STRATEGIC LOCATIONS

HARDNESS CONTROL PAYS

No. 473 GREEN HARDNESS TESTER

One fast pocket-size tester for all green sand molds and cores. Buckles, scabs and dirt result from variable mold hardness. Veining and burn-on result from uneven core ramming.

Use the Green Hardness Tester to find the right hardness and control at that value for improved casting quality.

No. 673 DRY HARDNESS TESTER

A rapid Hardness tester for baked cores and dried molds. Use the Dry Hardness Tester to control surface hardness of production cores. Make adjustments in binder, moisture or baking to obtain best hardness based on casting results. Note these advantages:

1. Always ready for use.
2. Scratch Hardness in three seconds.
3. Rotary Hardness in two seconds.
4. Direct easy-to-read dial.
5. Does not spoil core surface.

Write for Leaflet "Mold and Core Hardness Facts"

CONTROL EQUIPMENT
HARRY W. DIETERT COMPANY
9330 ROSELAWN • DETROIT 4, MICH.

committee news

continued from page 86

Policy committees

During the past six months a number of Board Policy Committees have met to recommend more definite Society policies for approval by the A.F.S. Directors. The purpose of these committee activities is to provide guides for the Board, the chapters and membership and the National Office Staff in carrying on the many phases of Society affairs.

None of the policies approved by the Board need be considered permanent, as machinery has been set up for future policy revisions as necessary. No established policy can be revised at a single Board meeting, but must be referred to a proper committee for recommendation to a later meeting of the Directors.

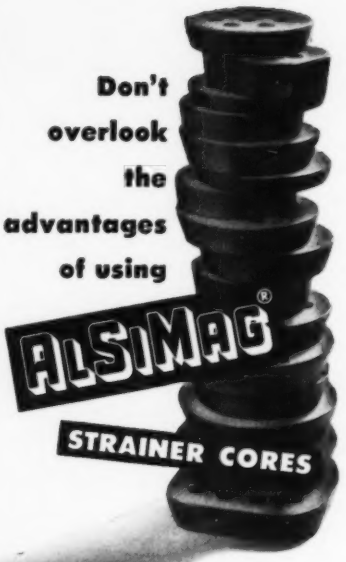
Policy committees which have met during the current fiscal year have covered the following activities: Finances, Technical Activities, Administration, Publications, Conventions and Exhibits, Chapter and Membership, and Education at the Training Level. The first three committees named made their recommendations at the November 17 meeting of the Board; recommendations of the other committees will be presented at the March 20 Board meeting.

Board reorganization

In recent years, Society officials have discussed the need for reorganizing the present national directorate, with a view toward better and more constant liaison with the chapters and in an effort to relieve the incumbent president and vice-president of excessive time demands and travel while in office. Constant growth of the chaper organization, more regional foundry conferences, and a growing number of administrative meetings has placed an undue burden on those charged with responsibility for directing the Society's affairs.

At the November 1952 meeting of the Board, a Board Reorganization Committee was appointed and met in January to recommend a plan, to be presented at the March 20 meeting of the Board. Since any changes contemplated involve revision of the Society by-laws, the matter will be referred to a meeting of the By-Laws Committee to be held early in April, prior to submittal for vote of the membership.

Don't overlook the advantages of using



Modern foundry practice includes the use of strainer cores to keep sand particles from getting into the casting. AlSiMag Ceramic Strainer Cores do this job best. They offer every advantage possible for this type of cleaner casting insurance.

- Little abrasion from metal stream
- Allow positive even flow of metal
- Even thermal expansion
- Withstand all normal pouring temperatures
- Tough, easy to use on fast production

ALSIMAG CUT-OFF CORES
Are made to help you eliminate labor in your cut-off department. They are flat, precision made ceramic cores that fit into the neck of the riser. They allow you to break riser off in one easy operation.

ALSIMAG GATE TUBES
Are used to form a smooth ceramic gate lining. Cleaner castings are assured since the incoming metal has no contact with gate sand.

SAMPLES WILL BE SENT ON REQUEST
Test these AlSiMag products in your own foundry. We believe you, too, will agree that their use is another step toward foundry economy. Stock sizes sent free. Samples to your specifications at minimum cost.

AMERICAN LAVA CORPORATION
50 YEARS OF CERAMIC LEADERSHIP
CHATTANOOGA 5, TENNESSEE

free information

continued from page 18

For further information about free literature use the card on page 18.

the non-ferrous foundry to reduce finishing costs on all castings. Illustrated case histories cover brass, bronze, aluminum, and allied fields. Performance data given for both small and large. *American Wheelabrator & Equipment Co.*

For more data circle No. 23 on card, page 18

Fire Clays

Folder (2M-1-53-K-P) lists three fire clays designed to meet a wide range of requirements. Essential properties of the clays are discussed at length. Explanation is given concerning proper selection and preparation of clays. *Eastern Lay Products.*

For more data circle No. 24 on card, page 18

Dust control

Catalog showing complete line of dust control equipment for foundries. Two-color, 28-page book gives latest information, installation pictures and diagrams. *Claude B. Schneible Co.*

For more data circle No. 25 on card, page 18

Cleaning equipment

Blastmaster Rotoblast is described in 12-page, two-color bulletin (No. 223). Eight exclusive construction features that make this new machine especially attractive are listed (among them an abrasive-tight door). Bulletin explains how production savings may be realized. Gives detailed dimensions and specifications of both the 6- and 12-ft. models shows how "GN" barrel can fit into operations. *Pangborn Corporation.*

For more data circle No. 26 on card, page 18

Sling chains

New chart makes sling chain selection easier, simpler and safer. Identifies types of sling chains and attachments used for lifting any given load. Gives working load limits of single, double, triple and multiple-branch slings, when used at angles of from 60 to 10 deg. Back of chart lists tips on use and care of sling chains. *The McKay Co.*

For more data circle No. 27 on card, page 18

Magnesium crucibles

Illustrated brochures (Nos. PM100, SH110, H121) contain information about recent developments in steel-fabricated crucibles for magnesium melting. Explain design refinements which eliminate copper and nickel contamination, resists distortion under high heat, and achieves better heat transfer. *American Tank and Fabricator Co.*

For more data circle No. 28 on card, page 18

"FALLS BRAND" ALLOYS
AMERICA'S LARGEST PRODUCERS OF ALLOYS

"FALLS"
COPPER MASTER
ALLOYS

Calcium Copper . . . . . .
. . . . . **Cobalt Copper**
Chromium Copper . . . . . .
. . . . . **Iron Copper**
Magnesium Copper . . . . . .
. . . . . **Manganese Copper**
Nickel Copper . . . . . .
. . . . . **Phosphor Copper**
Silicon Copper . . . . . .
. . . . . **Tellurium Copper**

WRITE FOR COMPLETE DETAILS

NIAGARA FALLS
Smelting & Refining Division
Continental Copper & Steel Industries, Inc.
BUFFALO 17, NEW YORK

Fussy People

Are among the many customers who insist on exclusive use of—

SCIENTIFIC Quality MATCH PLATES

SCIENTIFIC MATCH PLATES Pressure Cast

They like our service, too. Write for Bulletin

THE SCIENTIFIC CAST PRODUCTS CORP.

1390 East 40th Street
CLEVELAND 3, OHIO

2520 West Lake Street
CHICAGO 12, ILLINOIS

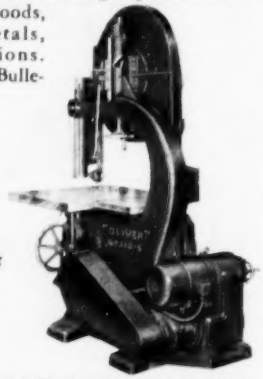
"OLIVER"

30-inch Metal Cutting

BAND SAW

Has high speed motor for cutting plastics, aluminum and other sheet metals . . . or with variable low speed motor for cutting heavy cross sections.

Cuts true, steady and smooth. Extra large capacity under guide. Has variable low speed geared head direct connected to lower wheel for cutting light and heavy cross sections. Also furnished with high speed motor for cutting woods, sheet metals, compositions. Write for Bulletin 217-S.

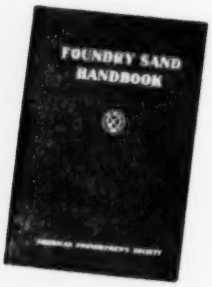


"Oliver" Metal Cutting Band Saws also made in 18", 36", 38" sizes.

OLIVER MACHINERY COMPANY
GRAND RAPIDS 2, MICH.

FOUNDRY SAND HANDBOOK

LOOK!



1 Completely rewritten by prominent foundry sand specialists
2 Twice as much information as contained in 5th edition
3 Includes a glossary
4 Includes a bibliography
5 259 pages . . . 93 illustrations

Prices AFS Members.....$3.50
Non-Members.....$5.25

Sand Control is of Vital Importance TO YOU!

CHAPTERS COVER: Mode of Occurrence of Sands and Clays . . . Methods for Sampling Foundry Sands and Clays . . . Preparing Foundry Sand Mixtures for Testing . . . Methods for Determining Fineness of Foundry Sands—Standard . . . Determining Moisture in Foundry Sand Mixtures—Standard . . . Determination of Permeability of Foundry Sands . . . Strength of Foundry Sand Mixtures . . . Method for Determination of Green Surface Hardness—Standard . . . Determining the Sintering Point of Sand Mixtures . . . Elevated Temperature Tests on Foundry Sand Mixtures . . . Chemical Analysis of Sand—Non Standard Tests . . . Tentative Method of Testing Core Binders (Tensile Strength) . . . Mechanical Properties of Core Sand Mixtures . . . Method for Determining Strength of Core Paste—Tentative Standard . . . Non-Standard Tests . . . Interpretation of Room Temperature Sand Tests . . . Comments on Maintenance of Testing Equipment . . . Foundry Molding Sand Mixtures . . . Conversion Tables . . . Terms Used in Foundry Sand Work . . . Bibliography on Sand Testing and Control . . . Subject Index.

REMEMBER . . . no one can *consistently* produce quality castings in molds prepared from uncontrolled sand mixtures!

AMERICAN FOUNDRYMEN'S SOCIETY
616 South Michigan Avenue, Chicago 5, Illinois

foundrymen

continued from page 30

territory will include Texas, Oklahoma, Arkansas, Louisiana, Mississippi and part of New Mexico.

Ralph Severson has joined Universal-Rundle Corp., Milwaukee, as foundry metallurgist. He was recently a manufacturing engineer in the Trafford (Pa.) foundry of Westinghouse Electric Corp.

F. Raymond Leas has been appointed vice-president of Empire Steel Castings, Inc., Reading, Pa.

Frederic B. Stevens, Inc., Detroit, has appointed the following sales representatives: **Paul E. Williams,** Elkhart, Ind., for the Indianapolis branch; **John W. Greenstreet** for the Chesapeake Bay-New Jersey territory; **Renard Brown,** Rochester, N. Y., for the foundry supplies division in southern New York and northeastern Pennsylvania; and **Dan C. Cowen,** Wabash, Ind., foundry equipment and supply sales in Illinois and Iowa.

John W. Weaver has been named sales manager of the casting division, Waukesha Foundry Co., Waukesha, Wis. He has been with the company for 18 years in the sales department.

Burtron Zook has been appointed sales manager for Jensen Specialites, Inc., Detroit. A Jensen sales engineer for the last seven years, he takes over from **Paul H. Goodell** who will continue with Jensen in a consulting capacity on engineering and development problems connected with radiant heat.

C. L. Petty, Jr., has been appointed district sales manager of the Philadelphia office of A. P. Green Fire Brick Co., Mexico, Mo.

British Columbia Research Council, University of British Columbia, Canada, announces the following new appointments in the metallurgy division: **I. D. G. Berwick,** Cambridge University and **J. E. Srawley,** formerly with British Cast Iron Research Association.

Appointment of **J. W. Morgan** as assistant sales manager of eastern industrial truck sales has been announced by Hyster Co., Portland, Ore.

Claude A. Gates, New Rochelle, N. Y., previously vice-president of Wheelco Instruments Co., has been appointed the Claud S. Gordon Co. representative in New York City, northern New Jersey, Long Island, Westchester, and western Connecticut areas.

Horace C. Cook has been appointed works manager of the Buffalo magnesium foundry of Aluminum Company of

America. Formerly plant superintendent, he succeeds Sanford H. Bennett, who has been promoted chief industrial engineer of Alcoa's Casting Div. **Norbert C. Hilbrecht** succeeds Mr. Cook as plant superintendent and **Sherwood Willard** takes over Mr. Hilbrecht's former position of chief industrial engineer at the Buffalo plant.

Electro Metallurgical Co., division of Union Carbide & Carbon Corp., New York, has appointed **Paul McVicker** technical director of operations. His headquarters will be in Niagara Falls. Mr. McVicker started with UCC in 1926 and has worked in various executive capacities at the New York works manager's office as well as the Niagara Falls plant. Appointment of **S. L. Jackson** as district manager of the Los Angeles office and **R. L. Reed** as district manager of the Detroit office of Electro Metallurgical Co., has also been announced.

Harry C. Davis, general manager, Kanawha Manufacturing Co., Charleston, W. Va., was recently elected president of the Conveyor Equipment Manufacturers Association, Washington, succeeding **G. Walter Ostrand,** Link-Belt Co., Chicago. **R. C. Sollenberger** was re-elected executive vice-president. Other officers ininclude: Vice-president, **R. F. Tomlinson,** A. B. Farquhar Div., Oliver Corp., York, Pa.; secretary, **Fred S. Wells,** Stephens-Adamson Manufacturing Co., Aurora, Ill. Elected directors were: **J. A. Jeffrey,** Jeffrey Manufacturing Co., Columbus, Ohio; **Lee Sekulski,** Mathews Conveyor Co., Elwood City, Pa.; and **R. B. Maas,** Screw Conveyor Corp., Hammond, Ind.

Benjamin E. Weimer has been appointed purchasing agent, Wellman Bronze & Aluminum Co., Cleveland, succeeding the late **John Wellman. Malcom P. Avery** succeeds Mr. Weimer as head of the customer relations department. **William W. Lamb,** formerly vice-president and general manager, Ohio Magnesium Castings Co., Cleveland, was recently appointed Wellman sales representative. **Judson S. Wickham** is Wellman's newly appointed director of industrial relations.

George J. Leroux, assistant manager, Cleveland Works, National Malleable & Steel Castings Co., has retired following 53 years of service. Mr. Leroux joined the old Toledo, Ohio, plant as a foundry timekeeper while attending St. John's College, and was transferred to the Cleveland works the following year.

Roland D. Block has been named plant metallurgist, Alten's Foundry & Machine Works, Inc., Lancaster, Ohio. He was previously assistant plant metallurgist, Cicero Works, National Malleable & Steel Castings Co., Chicago.

R. D. Phelps, Jr., secretary, Francis & Nygren Foundry Co., Chicago, was recently elected president of the Chicago Found-

Serving this Area

FOUNDRY SANDS • BONDING CLAYS • STEEL ABRASIVES

FOUNDED IN 1917

CARPENTER Brothers Inc.

MUSKEGON, MICH. Phone 4-7248
ST. PAUL, MINN. Phone EM 6312

606 W. WISCONSIN AVE., MILWAUKEE 3, WIS.
PHONE: DAly 8-0140

SEMET-SOLVAY FOUNDRY COKE

CONTROLLED—SEMET-SOLVAY's coke plants are equipped for quality production. Guesswork is eliminated, resulting in constant uniformity in the finished product. That is why, day in and day out, our foundry coke comes up to specifications — the specifications you have demanded.

SEMET-SOLVAY DIVISION
Allied Chemical & Dye Corporation
CINCINNATI • DETROIT
BUFFALO • CLEVELAND
In Canada: SEMET-SOLVAY COMPANY, LTD., TORONTO

for Better Melting

IF YOU WANT
BETTER LUMBER
CALL
DIAMOND 1-1200
for
PATTERNS
FLASKS
CRATING
SHELVING
ROLLERS
SKIDS
BOTTOM BOARDS
DOUGHERTY
LUMBER COMPANY
4300 EAST 68TH ST. CLEVELAND, OHIO

CONTACT THE FOUNDRY MARKET
WITH THESE SERVICES

- **Classified Advertising** — Rate $10 per column inch
- **Employment Service** (Position and Help Wanted) — "Position Wanted" Ads $5. "Help Wanted" Ads $10.
- **Professional Card Advertising** for Engineers and Consultants — Rate $10 per column inch insertion

American Foundryman
616 S. Michigan Ave. Chicago 5

● The gantry crane shown with this battery of EF batch type furnaces picks up castings from a receiving platform — loads them into the furnaces — removes them after heating — lowers them into the quench — removes them after quenching and places them on an unloading platform.

Our wide experience in all phases of heat treating and related material handling problems, puts us in a preferred position to solve most any ferrous or non-ferrous annealing or heat treating problem. We solicit your inquiries.

THE ELECTRIC FURNACE CO.
GAS FIRED, OIL FIRED AND ELECTRIC FURNACES FOR ANY PROCESS, PRODUCT OR PRODUCTION
Salem - Ohio
Canadian Associates ● CANEFCO LIMITED ● Toronto 1, Canada

rymen's Association. **R F. Grover,** vice-president and general manager, Love Bros. Corp., Aurora, Ill., was named vice-president. **C. V. Adams,** works manager Vulcan Iron Works Co., Chicago, was re-elected secretary-treasurer. **Mildred Kosar** continues as executive secretary. New directors include Mr. Grover, **C. A. Larson,** Reliance Pattern Works, and **C. T. Milles,** president, Charles H. Milles Foundry Co., Chicago.

Jacob S. Coxey, Jr., president and chairman of the board, Industrial Silica Corp., Youngstown, Ohio, has retired as president but will continue as board chairman. **P. Grant Forman** succeeds Mr. Coxey as president.

Carl N. Brown, since 1950 assistant general sales manager, United States Pipe & Foundry Co., Burlington, N. J., has been appointed sales manager for cast iron pipe. A graduate of Brown University, he has been engaged in sales work since he joined the company in 1925, previously serving in Philadelphia, Kansas City, Mo., Boston, and Chicago.

▶ *obituaries*

C. Louis Lane, 52, of Florence Pipe Foundry & Machine Co., Florence, N. J., died last December. Mr. Lane, who was chief metallurgist at Florence Pipe, had

C. Louis Lane

been with the company since 1915. He was a director of the Philadelphia Chapter of A.F.S. for many years and chairman for one term.

Commander Richard J. Wolf, U.S.N.R., 51, an engineer in the Industrial Div., Stone & Webster Engineering Corp., Boston, died January 28. A frequent contributor to the trade press, Mr. Wolf obtained a bachelor of science in mechanical engineering from Iowa State in 1922 and later earned a master's there. While engaged in engineering activities with industrial firms in the foundry and steel industries, he pioneered along with Dr. Anson Haves of Iowa State in the work on malleable iron. He joined the Navy in 1942 and

was stationed at the U. S. Naval Gun Factory at Washington, D. C., as assistant production officer. After discharge, as a Navy reserve officer, he was employed by the War Assets Administration as industrial specialist on foundry, welding and steel mill equipment. He was a member of the A.F.S. Plant & Plant Equipment Committee.

Commander Richard J. Wolf

James W. Fairburn, 66, an employee for 31 years of Ashland Malleable Iron Co., Ashland, Ohio, died recently. Mr. Fairburn, who was assistant works manager of Ashland, had been superintendent of the old Ashland Malleable plant and continued in that capacity after the company became a subsidiary of Union Malleable Manufacturing Co. in 1941.

Moses A. Temerson, head of the firm of Charles Temerson & Sons, Tuscaloosa, scrap iron and metal brokers, died January 26 of a heart attack. Mr. Temerson was an active supporter of the University of Alabama and together with his brothers set up the Temerson Chair of Physics at the university, which enables the school to offer a doctor's degree in physics. He was a member of the Birmingham Chapter of A.F.S.

George R. Weber, vice-president, treasurer and a director of Raybestos-Mahattan, Inc., Passaic, N. J., and general manager of its U. S. Asbestos Div., Manheim, Pa., died January 14 at his home in Lancaster, Pa.

Joseph Wright, vice-president, Western Foundry Co., Chicago, died December 16, 1952.

Willard H. Rother, 67, a national authority on gray iron, died December 12 after a brief illness. Mr. Rother had been associated for 41 years with Buffalo Foundry and Machine Co., which later became the Buflovak Equipment Div., Blaw-Knox Co. Mr. Roher joined Buffalo Foundry & Machine Co. in 1910 and two years later became chief metallurgist. In 1933 he was also appointed chief metallurgist and general manager of the Sumet Corp., Bronze Div., Buffalo

1918 1953

Serving American Foundrymen For 35 YEARS!

FOUNDRY SANDS . . FOUNDRY CLAYS

CARLOADS or CHICAGO WAREHOUSE

Washed, Dried and Screened Silica Sands and Flours
Molding Sands . . Core Sands . . Bentonites
All Types Fire Brick, Fire Clay, High Temperature Cements, Castables, Gunisters, etc.

WESTERN MATERIALS COMPANY

39 SOUTH LA SALLE STREET - CHICAGO 3, ILLINOIS

top quality
prompt service

EMPIRE

"THAT GOOD"

FOUNDRY COKE

DEBARDELEBEN COAL CORPORATION

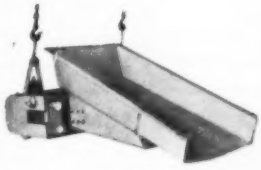
2201 First Ave., North Birmingham 3, Ala.
Phone 3-9135

Feeding tempered foundry sand to a pneumatic mold.

VIBRATORY FEEDERS

SYNTRON

Simplify Your Sand Handling

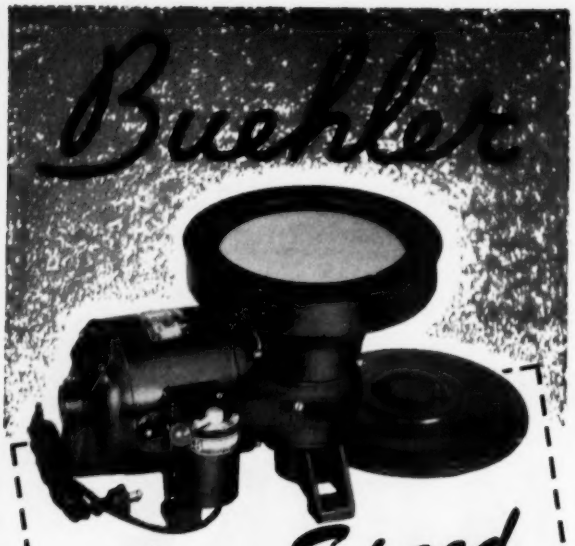


Syntron Feeders not only simplify and speed up sand handling, they are economical to operate. Their electro-magnetic drive eliminates gears, cams or belts that require expensive replacement. Finger-tip controlled feeding from pounds to hundreds of tons per hour. Provide efficient handling of most materials from heavy lumps to pulverized substances—wet or dry—hot or cold.

Write today for FREE Catalogue Information

SYNTRON COMPANY

545 Lexington Ave. Homer City, Penna.



Low Speed Polisher No. 1505-2

. . . . for accurate final polishing

Low speed polishing is increasingly popular for the final step, particularly where soft non-ferrous metals are encountered. The production of smooth polished samples with a minimum of surface scratches and disturbed metal is the outstanding feature of this low speed Buehler Polisher No. 1505-2. Built to operate at selective speeds of 150 r.p.m. and 250 r.p.m. through a positive gear head drive housed in an oiltight base, this polisher represents the highest development in equipment for precision finishing of specimens. This polisher is also perfectly suited to the wax lap or lead lap polishing technique preferred by many metallurgists.

The 8" diameter polishing disc is attached to a countershaft by a tapered sleeve. This tapered fit and long span between bearings assures smooth operation. The motor is ¼ h.p. single phase ball bearing, operating on 110 V., 60 Cycle AC current. Shipping weight, 80 lbs.

The BUEHLER line of specimen preparation equipment includes
—CUT-OFF MACHINES • SPECIMEN MOUNT PRESSES • POWER GRINDERS • EMERY PAPER GRINDERS • HAND GRINDERS • BELT SURFACERS • POLISHERS • POLISHING CLOTHS AND POLISHING ABRASIVES

Buehler Ltd.
A PARTNERSHIP

METALLURGICAL APPARATUS
165 West Wacker Drive, Chicago 1, Illinois

index to Advertisers

32 Allis-Chalmers Mfg. Co., Tractor Division
5 American Air Filter Co., Inc.
108 American Lava Corp.
33 American Monorail Co.
116 **Inside Back Cover** Archer-Daniels-Midland Co. (Foundry Products Div.)
4 Baroid Sales Div., National Lead Co.
75-76 Beardsley & Piper, Div. Pettibone Mulliken Corp.
114 Buehler Ltd.
104 Campbell-Hausfeld Co.
7 Carborundum Co., The
70 Carl-Mayer Corp.
111 Carpenter Bros., Inc.
107 Clark Equipment Co., Industrial Truck Div.
115 Classified Advertisers
91 Cleveland Flux Co.
113 De Bardeleben Coal Corp.
8 Delta Oil Products Co.
108 Dietert, Harry W., Co.
6 Dow Corning Corp.
112 Dougherty Lumber Co.
26 Eastern Clay Products Dept., International Minerals & Chemical Corp.
85 Eastman Kodak Co.
112 Electric Furnace Co.
20 Electro Metallurgical Co., A Division of Union Carbide & Carbon Corp.
1 Federal Foundry Supply Co.
24-25 Foundry Equipment Co.
105 Harsell Engineering Co.
22 Illinois Clay Products Co.
19 Industrial Equipment Co.
79 International Nickel Co.
92 Knight, Lester B., & Associates, Inc.
9 Link-Belt Co.
106 Martin Engineering Co.
2 Modern Equipment Co.
14 National Carbon Co., A Division of Union Carbide & Carbon Corp.
10 Newaygo Engineering Co.
109 Niagara Falls Smelting & Refining Div., Continental Copper & Steel Industries, Inc.
34 Ohio Ferro-Alloys Corp.
110 Oliver Machinery Co.
28 Pangborn Corp., Malleabrasive Div.
89 Penola Oil Co.
Inside Front Cover Pittsburgh Lectromelt Furnace Corp.
27 Schneible, Claude B., Co.
110 Scientific Cast Products Corp.
111 Semet-Solvay Div., Allied Chemical & Dye Corp.
21 Sterling Wheelbarrow Co.
12 Stevens, Frederic B., Inc.
113 Syntron Co.
16 Tennessee Products & Chemical Corp. Union Carbide & Carbon Corp. Electro Metallurgical Co.
14 National Carbon Co.
13 Universal Engineering Co.
113 Western Materials Co.
Back Cover Whiting Corp.

American Foundrymen's Society Publications

31 Pattern Makers' Manual
87 Foundry Work
110 Foundry Sand Handbook
112 American Foundryman
95 Book List

classified

■ To contact advertisers with code number, write to AMERICAN FOUNDRYMAN, 616 S. Michigan Ave., Chicago 5, Ill. In replying to "Help Wanted," send outline of background.

▶ Help Wanted

Superintendent

Opportunity for well qualified, experienced superintendent of non-ferrous foundry employing 100 to 150. Applicant should be between 35 and 45. Enclose photograph and state complete record of education and experience in detail including previous employment and length of service. **HW-602**

Foundry Supervisory Personnel

Qualified foreman for all operations in highly mechanized, established malleable foundry. Positions open immediately. Must be familiar with progressive foundry techniques. State qualifications. Located Midwest. **HW-631**

Foundry Engineers and Draftsmen

Having foundry operating or plant experience. Write, enclosing photograph and complete record of education and experience in detail, including previous employers and length of service. State age and salary expected.

Lester B. Knight & Associates, Inc.
Consulting Engineers
600 W. Jackson Blvd. Chicago 6, Ill.

Steel Superintendent

Experienced in gating, risering, and pattern layout. Chicago area. **HW-633**

Foundry Superintendent

Unusual opportunity in medium size brass, aluminum and iron foundry. Long-term expansion program requires superintendent with thorough knowledge of machine and floor molding, gating and setups for jobbing and production work. Applicant must know all phases of foundry work and be capable of producing pressure-tight and porous-free castings economically. Prefer applicant not over 45. **HW-635**

Field Service Men

Excellent opportunity for men to demonstrate correct use of synthetic resin core binders in midwest. Car, salary, bonus and expense account. Give full details and references. **HW-637**

Metallurgist

Small steel foundry, Western Canada. Knowledge of stainless steel castings preferred, including general foundry practice. Write, stating age, experience and salary expected —Canadian preferred. **HW-638**

Sand Salesman

Well established firm needs reliable man to sell foundry sands in middle west. **HW-639**

Sales or Product Development Engineer

Industrial Sales Engineer with sound knowledge of basic engineering principles, preferably with some cast iron foundry experience. Permanent position with well established corporation. Opportunity for advancement. Send details, age, experience, etc. **HW-640**

Sales Engineer

We're looking for a technically trained man, preferably one familiar with foundry practices and who has been calling on foundries in a technical sales capacity. This position involves calling on Midwest foundries, selling special resins. Excellent opportunity with a leading resin manufacturer. **HW-641**

▶ Professional Services

METALLURGICAL
CHEMISTS *Accuracy* — **CONSULTANTS** *Service*
ACCURATE METAL LABORATORIES
2454 W. 38th St. • Phone: VI 7-6090 • Chicago 32, Ill.

Westover ENGINEERS
FOUNDRY MANAGEMENT CONSULTANTS
3110 West Fond Du Lac Ave., Milwaukee 10, Wis.
There is no better time than NOW to review incentives, methods, scheduling, production control and paperwork processes.

SESSIONS ENGINEERING CO.
Consulting Foundry Engineers
Modernization. Processing Layouts
Cost Reduction Quality Control
Product—Machine Design
Architectural Design
One North La Salle St. Chicago 2, Ill.

Lester B. Knight & Associates, Inc.
Member A.C.M.E.
Consulting Engineers
Management • Sales • Production • Surveys
Modernization • Mechanization
600 West Jackson Blvd., Chicago 6, Ill.
Eastern Office: Lester B. Knight and Associates
50 Church St., New York 7, N. Y.

X-RAY INSPECTION
SPECTROCHEMICAL ANALYSIS
TESTING AND RESEARCH
METALLURGICAL AND CERAMIC FIELDS
Centrally located in New England
J. DIRATS & CO., INC.
Notre Dame St. Westfield, Mass. Phone 2260

EARL E. WOODLIFF
FOUNDRY SAND ENGINEER
Consulting • • Testing
14611 Fenkell (5-Mile Rd.) Detroit 27, Mich.
Res. Phone Vermont 5-8724

W. G. REICHERT ENGINEERING CO.
PROFESSIONAL FOUNDRY ENGINEERS
Surveys • Modernization
Operations • Management
1060 Broad St. Newark 2, N. J.
Industrial Bldg.

CHEMISTS and METALLURGISTS
Grey Iron Foundry Consultants
Complete Foundry Testing
Established over 25 years
A. H. PUTNAM COMPANY
Rock Island, Illinois

▶ Positions Wanted

Foundry Superintendent

Can take complete charge of all foundry operations in gray iron and brass. Technical graduate, mechanical engineering. 25 years' experience in heavy and light castings, jobbing and production work, specializing in automotive, pump, compressor, and machine tool castings. Actual molding, coremaking, melting and metallurgical experience aid in understanding and promotion of good management-employee relationships. Thoroughly grounded in sand control, quality control and standard costs. **PW-186**

Sales-Service Representative

Gray iron representative with technical background, excellent contacts and friendly customer relations in automotive and related fields. Wide foundry experience. Age 32. Free to travel or relocate. **PW-188**

Metallurgist

Marine Corps officer due for discharge in June. B.S. mechanical engineering, major in metallurgy. $2\frac{1}{2}$ years' experience in steel jobbing foundry, one year aluminum. Veteran two wars. Age 27. Minimum danger of recall. Seeks position in foundry metallurgy or combination metallurgical-management. **PW-187**

▶ For Sale

Central Ohio Foundry

Modern Equipment - Bldgs. A-1 Condition
52,000 sq ft - Cast Iron Products
Reasonable
N. F. Fogel — **Cincinnati, Ohio**
713 Keigh Bldg. Phone: PA 3100

Foundry Equipment . . . Late Type

5 ton Link-Belt "Speeder" Portable Crane, 20 ft Boom; Jeffery portable sand conditioner, Type P, class 1; Coleman core and mold oven, 2 compt., gas fired, 4 doors, door openings 35 in. H x 42 in. W x 40 in. deep, with blower and controls; Foundry Equipment Co., gas fired heat circulating unit; 1000 lb Toledo printweight electric scale; 400, 2000 and 3000 lb Modern & Whiting ladles; 14 in. x $8\frac{3}{4}$ x 10 in. Sullivan 2-stage air compressor, 75 HP motor; complete Monorail system for carrying ladles; Approximately $30,000 of pressed steel, cast steel, and aluminum flasks.

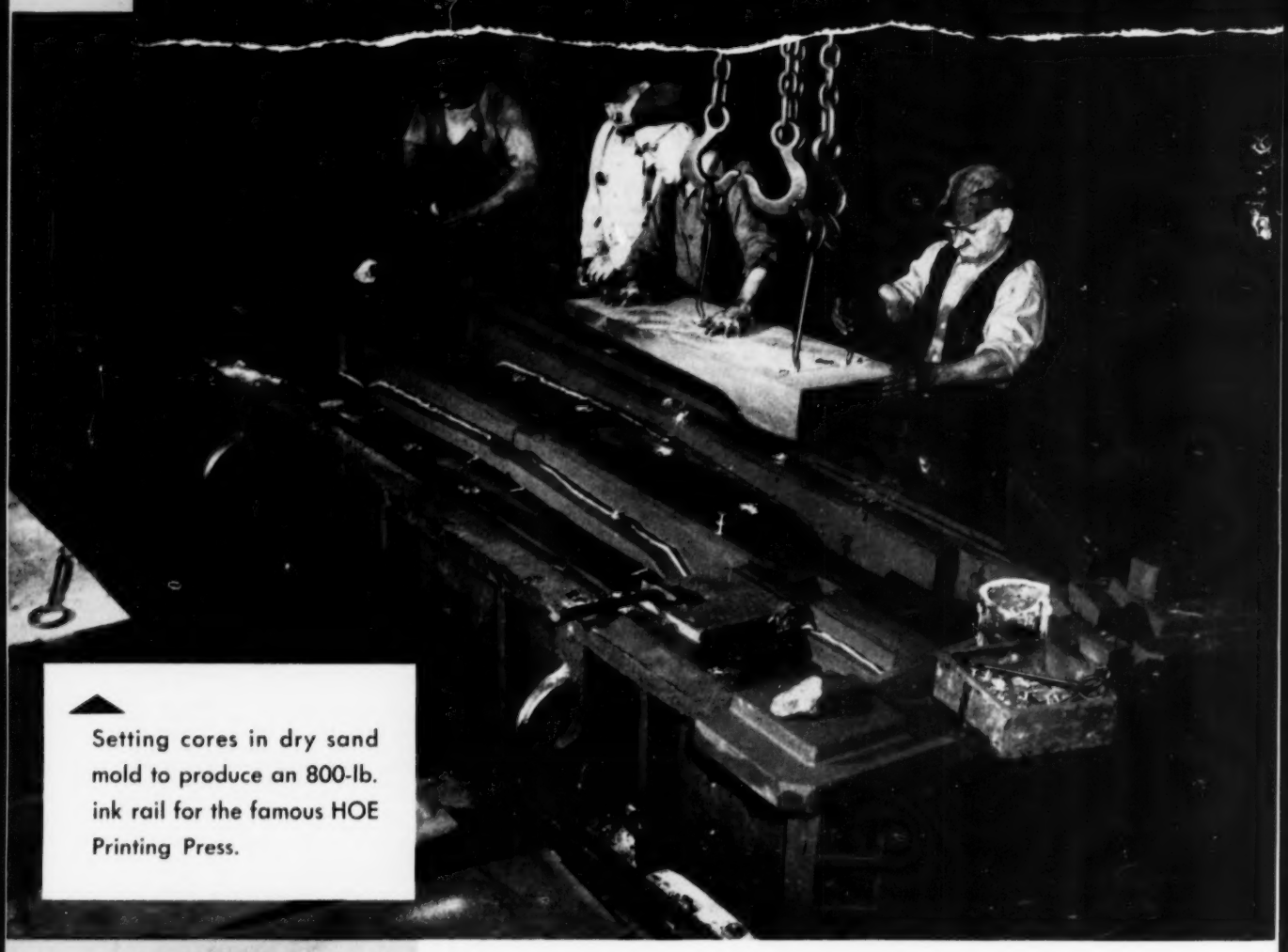
Industrial Plants Corporation
316 S. La Salle St. Chicago 4

Trouble Shooting
Technical & Cost
CARL E. ROWE & COMPANY
125 E. Wells St. Milwaukee 2, Wis.
Phone Marquette 8-2851

GEO. N. WILEMAN
Consulting Engineers
to
The Foundry Industry
Plant & Equipment
Commercial Trust Bldg. Philadelphia 2, Penna.

Harold J. Roast
F.I.M., F.C.S., M.E.I.C.
BRONZE FOUNDRY CONSULTANT
c/o Crown Trust Co.
284 Dundas St. London, Ont., Canada
Available Coast to Coast

INSEPARABLE FOR



Setting cores in dry sand mold to produce an 800-lb. ink rail for the famous HOE Printing Press.

Cores for ink rails (see above) are made ready for over-night bake at 375-400° in oil-fired batch-type oven. Sand-LINOIL ratio of 50 to 1 by volume is used.

OVER 1/4 CENTURY

HOE

uniform LINOIL plays important part in production of quality cores at R. HOE & CO., INC.

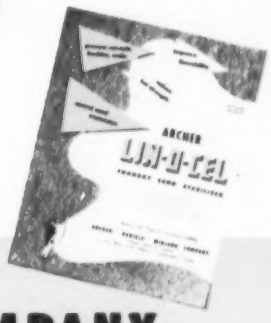
The Dunellen (N. J.) Foundry Division of R. Hoe & Co., Inc., pours semi-steel castings of all sizes for their famous high-speed printing presses. Giant machine tool bases ranging up to nine tons is also their business.

The size and cost of such work calls for fool-proof cores, unvarying in strength, hardness and collapsibility. That's why the core room foreman at Hoe has used trouble-free LINOIL for 26 years! They can depend upon its uniformity to produce consistent cores without having to vary the mixture from month to month.

Your LINOIL representative will be pleased to demonstrate LINOIL in your core room. Ask him next time he calls, or write direct to the address below for more information.

just off the press

New bulletin on Archer LIN-O-CEL Sand Stabilizer tells how to improve flowability, prevent rat-tails, buckles and scabs. Write for your copy TODAY.



ARCHER·DANIELS·MIDLAND COMPANY

FOUNDRY PRODUCTS DIVISION • 2191 WEST 110th STREET • CLEVELAND 2, OHIO

PRODUCERS OF **LINOIL** **INDUCTOL** **FREFLO** **LIN-O-CEL**

Write for this

IMPORTANT WHITING BOOKLET today!

Here's a new booklet that may help you solve some of your melting problems! It discusses such vital subjects as today's pig iron and coke problems . . . how to reduce bridging . . . how to handle coke with less damage . . . what types of charging buckets do the best job . . . and tips on preheated blast. Write for this 6 page informative booklet today . . . just ask for Bulletin FO-8.

WHITING CORPORATION

15628 Lathrop Ave., Harvey, Illinois

suggestions for solving some cupola operation problems

WHITING CORPORATION

HARVEY, ILLINOIS

Another WHITING Service

BULLETIN FO-8